

Project Solution Lab 2:

Problem: Predicting Credit Card Fraud

Introduction to business scenario

You work for a multinational bank. There has been a significant increase in the number of customers experiencing credit card fraud over the last few months. A major news outlet even recently published a story about the credit card fraud you and other banks are experiencing.

As a response to this situation, you have been tasked to solve part of this problem by leveraging machine learning to identify fraudulent credit card transactions before they have a larger impact on your company. You have been given access to a dataset of past credit card transactions, which you can use to train a machine learning model to predict if transactions are fraudulent or not.

About this dataset

The dataset contains transactions made by credit cards in September 2013 by European cardholders. This dataset presents transactions that occurred over the course of two days and includes examples of both fraudulent and legitimate transactions.

Features

The dataset contains over 30 numerical features, most of which have undergone principal component analysis (PCA) transformations because of personal privacy issues with the data. The only features that have not been transformed with PCA are 'Time' and 'Amount'. The feature 'Time' contains the seconds elapsed between each transaction and the first transaction in the dataset. The feature 'Amount' is the transaction amount. 'Class' is the response or target variable, and it takes a value of '1' in cases of fraud and '0' otherwise.

Features: V1, V2, ... V28 : Principal components obtained with PCA

Non-PCA features:

- Time : Seconds elapsed between each transaction and the first transaction in the dataset, $T_x - t_0$
- Amount : Transaction amount; this feature can be used for example-dependent cost-sensitive learning
- Class : Target variable where Fraud = 1 and Not Fraud = 0

Dataset attributions

Website: <https://www.openml.org/d/1597> (<https://www.openml.org/d/1597>)

Twitter: <https://twitter.com/dalpozz/status/645542397569593344>
<https://twitter.com/dalpozz/status/645542397569593344>

Authors: Andrea Dal Pozzolo, Olivier Caelen, and Gianluca Bontempi Source: Credit card fraud detection - June 25, 2015 Official citation: Andrea Dal Pozzolo, Olivier Caelen, Reid A. Johnson, and Gianluca Bontempi. Calibrating Probability with Undersampling for Unbalanced Classification. In Symposium on Computational Intelligence and Data Mining (CIDM), IEEE, 2015.

The dataset has been collected and analyzed during a research collaboration of Worldline and the Machine Learning Group (mlg.ulb.ac.be) of ULB (Université Libre de Bruxelles) on big data mining and fraud detection. More details on current and past projects on related topics are available on <http://mlg.ulb.ac.be/BruFence> (<http://mlg.ulb.ac.be/BruFence>) and <http://mla.ulb.ac.be/ARTML> (<http://mla.ulb.ac.be/ARTML>).

Step 1: Problem formulation and data collection

Start this project off by writing a few sentences below that summarize the business problem and the business goal you're trying to achieve in this scenario. Include a business metric you would like your team to aspire toward. With that information defined, clearly write out the machine learning problem statement. Finally, add a comment or two about the type of machine learning this represents.

Project presentation: Include a summary of these details in your project presentations.

Read through a business scenario and:

1. Determine if and why ML is an appropriate solution to deploy.

Write your answer here

2. Formulate the business problem, success metrics, and desired ML output.

Write your answer here

3. Identify the type of ML problem you're dealing with.

Write your answer here

4. Analyze the appropriateness of the data you're working with.

Write your answer here

Setup

Now that we have decided where to focus our energy, let's set things up so you can start working on solving the problem.

Note: This notebook was created and tested on an `ml.m4.xlarge` notebook instance.

```
In [1]: # Import various Python Libraries
```

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import time

sns.set()
%matplotlib inline
```

In [2]: # Install imblearn

```
!pip uninstall scikit-learn -y
!pip install imbalanced-learn==0.7.0
!pip install imblearn
```

```
Found existing installation: scikit-learn 0.22.1
Uninstalling scikit-learn-0.22.1:
  Successfully uninstalled scikit-learn-0.22.1
Collecting imbalanced-learn==0.5.0
  Downloading imbalanced_learn-0.5.0-py3-none-any.whl (173 kB)
    █████████████████████████████████████████████████████████████████████████████████| 173 kB 4.6 MB/s eta 0:00:01
Collecting scikit-learn>=0.21
  Downloading scikit_learn-0.23.2-cp36-cp36m-manylinux1_x86_64.whl (6.8 MB)
    █████████████████████████████████████████████████████████████████████████████████| 6.8 MB 8.2 MB/s eta 0:00:01
| 348 kB 8.2 MB/s eta 0:00:01
Requirement already satisfied: numpy>=1.11 in /home/ec2-user/anaconda3/envs/mxnet_p36/lib/python3.6/site-packages (from imbalanced-learn==0.5.0) (1.18.1)
Requirement already satisfied: joblib>=0.11 in /home/ec2-user/anaconda3/envs/mxnet_p36/lib/python3.6/site-packages (from imbalanced-learn==0.5.0) (0.14.1)
Requirement already satisfied: scipy>=0.17 in /home/ec2-user/anaconda3/envs/mxnet_p36/lib/python3.6/site-packages (from imbalanced-learn==0.5.0) (1.4.1)
Collecting threadpoolctl>=2.0.0
  Downloading threadpoolctl-2.1.0-py3-none-any.whl (12 kB)
Installing collected packages: threadpoolctl, scikit-learn, imbalanced-learn
Successfully installed imbalanced-learn-0.5.0 scikit-learn-0.23.2 threadpoolctl-2.1.0
WARNING: You are using pip version 20.0.2; however, version 20.2.4 is available.
You should consider upgrading via the '/home/ec2-user/anaconda3/envs/mxnet_p36/bin/python -m pip install --upgrade pip' command.
Collecting imblearn
  Downloading imblearn-0.0-py2.py3-none-any.whl (1.9 kB)
Requirement already satisfied: imbalanced-learn in /home/ec2-user/anaconda3/envs/mxnet_p36/lib/python3.6/site-packages (from imblearn) (0.5.0)
Requirement already satisfied: scikit-learn>=0.21 in /home/ec2-user/anaconda3/envs/mxnet_p36/lib/python3.6/site-packages (from imbalanced-learn->imblearn) (0.23.2)
Requirement already satisfied: scipy>=0.17 in /home/ec2-user/anaconda3/envs/mxnet_p36/lib/python3.6/site-packages (from imbalanced-learn->imblearn) (1.4.1)
Requirement already satisfied: joblib>=0.11 in /home/ec2-user/anaconda3/envs/mxnet_p36/lib/python3.6/site-packages (from imbalanced-learn->imblearn) (0.14.1)
Requirement already satisfied: numpy>=1.11 in /home/ec2-user/anaconda3/envs/mxnet_p36/lib/python3.6/site-packages (from imbalanced-learn->imblearn) (1.18.1)
Requirement already satisfied: threadpoolctl>=2.0.0 in /home/ec2-user/anaconda3/envs/mxnet_p36/lib/python3.6/site-packages (from scikit-learn>=0.21->imbalanced-learn->imblearn) (2.1.0)
Installing collected packages: imblearn
Successfully installed imblearn-0.0
WARNING: You are using pip version 20.0.2; however, version 20.2.4 is available.
You should consider upgrading via the '/home/ec2-user/anaconda3/envs/mxnet_p36/bin/python -m pip install --upgrade pip' command.
```

Downloading the dataset

```
In [3]: # Check whether the file is already in the desired path or if it needs to be downloaded
import os
import subprocess
base_path = '/home/ec2-user/SageMaker/project/data/FraudDetection'
file_path = '/fraud.csv'

if not os.path.isfile(base_path + file_path):
    subprocess.run(['mkdir', '-p', base_path])
    subprocess.run(['aws', 's3', 'cp',
                   's3://aws-tc-largeobjects/ILT-TF-200-MLDWTs/credit_card_project/',
                   base_path, '--recursive'])
else:
    print('File already downloaded!')
```

Step 2: Data preprocessing and visualization

In this data preprocessing phase, you should take the opportunity to explore and visualize your data to better understand it. First, import the necessary libraries and read the data into a Pandas dataframe. After that, explore your data. Look for the shape of the dataset and explore your columns and the types of columns you're working with (numerical, categorical). Consider performing basic statistics on the features to get a sense of feature means and ranges. Take a close look at your target column and determine its distribution.

Specific questions to consider

1. What can you deduce from the basic statistics you ran on the features?
2. What can you deduce from the distributions of the target classes?
3. Is there anything else you deduced from exploring the data?

Project presentation: Include a summary of your answers to these and other similar questions in your project presentations.

Read the CSV data into a Pandas dataframe. You can use the built-in Python `read_csv` function ([documentation](https://pandas.pydata.org/pandas-docs/stable/reference/api/pandas.read_csv.html) (https://pandas.pydata.org/pandas-docs/stable/reference/api/pandas.read_csv.html)).

```
In [4]: df = pd.read_csv('/home/ec2-user/SageMaker/project/data/FraudDetection/fraud.csv')
```

Check the dataframe by printing the first 5 rows of the dataset.

Hint: Use the `<dataframe>.head()` function.

In [5]: `df.head()`

Out[5]:

	Time	V1	V2	V3	V4	V5	V6	V7	V8
0	0.0	-1.359807	-0.072781	2.536347	1.378155	-0.338321	0.462388	0.239599	0.098698
1	0.0	1.191857	0.266151	0.166480	0.448154	0.060018	-0.082361	-0.078803	0.085102
2	1.0	-1.358354	-1.340163	1.773209	0.379780	-0.503198	1.800499	0.791461	0.247676
3	1.0	-0.966272	-0.185226	1.792993	-0.863291	-0.010309	1.247203	0.237609	0.377436
4	2.0	-1.158233	0.877737	1.548718	0.403034	-0.407193	0.095921	0.592941	-0.270533

5 rows × 31 columns

In [6]: *# The class has a weird string instead of a boolean or numbers 0 and 1, so convert it to 0 and 1*

```
mapped_class = {"'0)": 0, "'1)": 1}
df['Class'] = df['Class'].map(lambda x: mapped_class[x])
```

In [7]: *# Check if that worked*

```
df.head()
```

Out[7]:

	Time	V1	V2	V3	V4	V5	V6	V7	V8
0	0.0	-1.359807	-0.072781	2.536347	1.378155	-0.338321	0.462388	0.239599	0.098698
1	0.0	1.191857	0.266151	0.166480	0.448154	0.060018	-0.082361	-0.078803	0.085102
2	1.0	-1.358354	-1.340163	1.773209	0.379780	-0.503198	1.800499	0.791461	0.247676
3	1.0	-0.966272	-0.185226	1.792993	-0.863291	-0.010309	1.247203	0.237609	0.377436
4	2.0	-1.158233	0.877737	1.548718	0.403034	-0.407193	0.095921	0.592941	-0.270533

5 rows × 31 columns

Question: What is the shape of your dataset?

Hint: To check the shape of a dataframe, use the `<dataframe>.shape` function.

In [8]: `df.shape`

Out[8]: (284807, 31)

Task: Validate all the columns in the dataset and see that they are what you read above: V1-V28 , Time , Amount , and Class .

Hint: Use `<dataframe>.columns` to check the columns in your dataframe.

In [9]: `df.columns`

Out[9]: `Index(['Time', 'V1', 'V2', 'V3', 'V4', 'V5', 'V6', 'V7', 'V8', 'V9', 'V10', 'V11', 'V12', 'V13', 'V14', 'V15', 'V16', 'V17', 'V18', 'V19', 'V20', 'V21', 'V22', 'V23', 'V24', 'V25', 'V26', 'V27', 'V28', 'Amount', 'Class'], dtype='object')`

Question: What can you find out about the column types and the null values? How many columns are numerical or categorical?

Hint: Use the `info()` function to check.

In [10]: df.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 284807 entries, 0 to 284806
Data columns (total 31 columns):
 #   Column   Non-Null Count   Dtype  
--- 
 0   Time      284807 non-null    float64
 1   V1        284807 non-null    float64
 2   V2        284807 non-null    float64
 3   V3        284807 non-null    float64
 4   V4        284807 non-null    float64
 5   V5        284807 non-null    float64
 6   V6        284807 non-null    float64
 7   V7        284807 non-null    float64
 8   V8        284807 non-null    float64
 9   V9        284807 non-null    float64
 10  V10       284807 non-null    float64
 11  V11       284807 non-null    float64
 12  V12       284807 non-null    float64
 13  V13       284807 non-null    float64
 14  V14       284807 non-null    float64
 15  V15       284807 non-null    float64
 16  V16       284807 non-null    float64
 17  V17       284807 non-null    float64
 18  V18       284807 non-null    float64
 19  V19       284807 non-null    float64
 20  V20       284807 non-null    float64
 21  V21       284807 non-null    float64
 22  V22       284807 non-null    float64
 23  V23       284807 non-null    float64
 24  V24       284807 non-null    float64
 25  V25       284807 non-null    float64
 26  V26       284807 non-null    float64
 27  V27       284807 non-null    float64
 28  V28       284807 non-null    float64
 29  Amount     284807 non-null    float64
 30  Class      284807 non-null    int64  
dtypes: float64(30), int64(1)
memory usage: 67.4 MB
```

Question: Perform basic statistics using the Pandas library and `Describe` function. What is the mean and standard deviation for the `amount` feature? What can you deduce from those numbers?

In [11]: `df.describe()`

Out[11]:

	Time	V1	V2	V3	V4	V5
count	284807.000000	2.848070e+05	2.848070e+05	2.848070e+05	2.848070e+05	2.848070e+05
mean	94813.859575	3.919560e-15	5.688174e-16	-8.769071e-15	2.782312e-15	-1.552563e-15
std	47488.145955	1.958696e+00	1.651309e+00	1.516255e+00	1.415869e+00	1.380247e+00
min	0.000000	-5.640751e+01	-7.271573e+01	-4.832559e+01	-5.683171e+00	-1.137433e+02
25%	54201.500000	-9.203734e-01	-5.985499e-01	-8.903648e-01	-8.486401e-01	-6.915971e-01
50%	84692.000000	1.810880e-02	6.548556e-02	1.798463e-01	-1.984653e-02	-5.433583e-02
75%	139320.500000	1.315642e+00	8.037239e-01	1.027196e+00	7.433413e-01	6.119264e-01
max	172792.000000	2.454930e+00	2.205773e+01	9.382558e+00	1.687534e+01	3.480167e+01

8 rows × 31 columns

Answer: Using the `describe` function, you can find some salient features of the dataset.

- The mean amount for this dataset is \$88 but this also consists of a lot of not fraud examples. But the max amount goes up to \\$25.
- The standard deviation for the Amount column is \$250.

Question: What is the mean, standard deviation, and maximum for the amount for the records that are fraud?

Hint: Use the built-in `mean()`, `std()`, and `max()` functions in dataframes.

```
In [12]: print("Fraud Statistics")

avg_amt = df[df['Class']== 1]['Amount'].mean()
std_dev = df[df['Class']== 1]['Amount'].std()
max_amt = df[df['Class']== 1]['Amount'].max()

print(f"The average amount is {avg_amt}")
print(f"The std deviation for amount is {std_dev}")
print(f"The max amount is {max_amt}")
```

```
Fraud Statistics
The average amount is 122.21132113821133
The std deviation for amount is 256.68328829771207
The max amount is 2125.87
```

Now look at the target variable, `Class`. First, you can find out what the distribution is for it.

Question: What is the distribution of the classes?

Hint: Use `<dataframe>['column_name'].value_counts()` to check the distribution.

```
In [13]: df['Class'].value_counts()
```

```
Out[13]: 0    284315  
          1     492  
          Name: Class, dtype: int64
```

Question: What can you deduce from the distribution of the classes?

Answer: The target variable distribution is very skewed. There are a lot of **not fraud** examples and very few **fraud** examples.

Question: What's the ratio of classes for 0s to the total number of records?

```
In [14]: 284315/(284315+492)
```

```
Out[14]: 0.9982725143693799
```

Visualize your data

If you haven't done so in the above, you can use the space below to further visualize some of your data. Look specifically at the distribution of features like `Amount` and `Time`, and also calculate the linear correlations between the features in the dataset.

Specific questions to consider

1. After looking at the distributions of features like `Amount` and `Time`, to what extend might those features help your model? Is there anything you can deduce from those distributions that might be helpful in better understanding your data?
2. Do the distributions of features like `Amount` and `Time` differ when you are looking only at data that is labeled as fraud?
3. Are there any features in your dataset that are strongly correlated? If so, what would be your next steps?

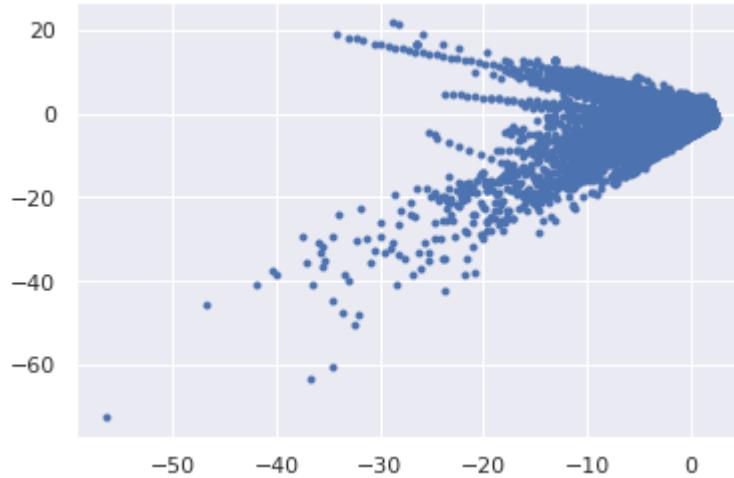
Use the cells below to visualize your data and answer these and other questions that might be of interest to you. Insert and delete cells where needed.

Project presentation: Include a summary of your answers to these and similar questions in your project presentations.

Start with a simple scatter plot. Plot V1 vs. V2. For more information about plotting a scatter plot, see the [Matplotlib documentation](https://matplotlib.org/3.1.1/api/_as_gen/matplotlib.pyplot.plot.html) (https://matplotlib.org/3.1.1/api/_as_gen/matplotlib.pyplot.plot.html).

```
In [15]: plt.plot(df['V1'], df['V2'], '.')
```

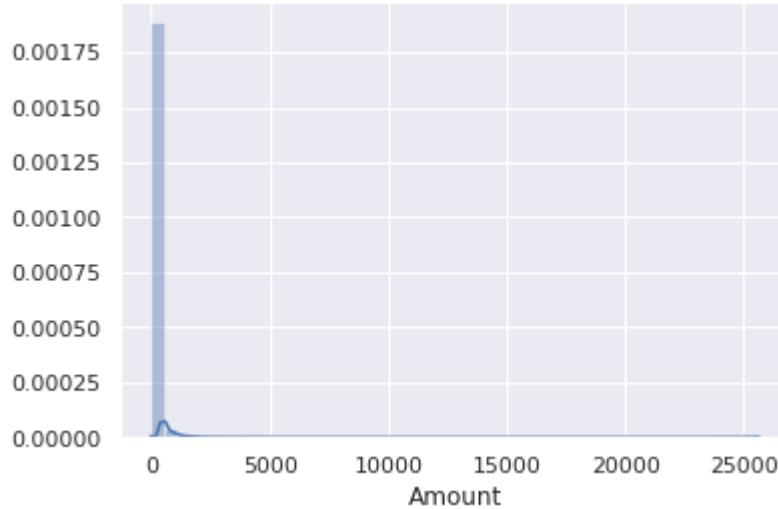
```
Out[15]: [<matplotlib.lines.Line2D at 0x7fd9836bfd30>]
```



Look at a distribution of some of the features. Use `sns.distplot()` to find the distribution of the individual features such as `Amount` and `Time`.

```
In [16]: sns.distplot(df['Amount'])
```

```
Out[16]: <code><matplotlib.axes._subplots.AxesSubplot at 0x7fd983674e10></code>
```



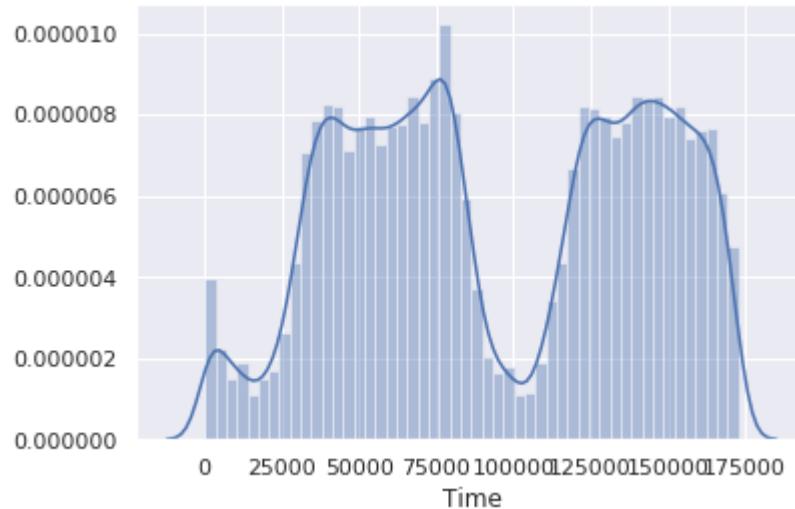
Question: Would the `Time` feature help you in any way? Look at the distribution again. What can you deduce from the scatter plot?

Answer: This distribution plot tells us the same thing that we saw in the `describe` function above. Most of the values are closer to \$100, but there are some that are bigger.

Plot a histogram and Kernel density estimation (KDE).

```
In [17]: sns.distplot(df['Time'])
```

```
Out[17]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd983601208>
```

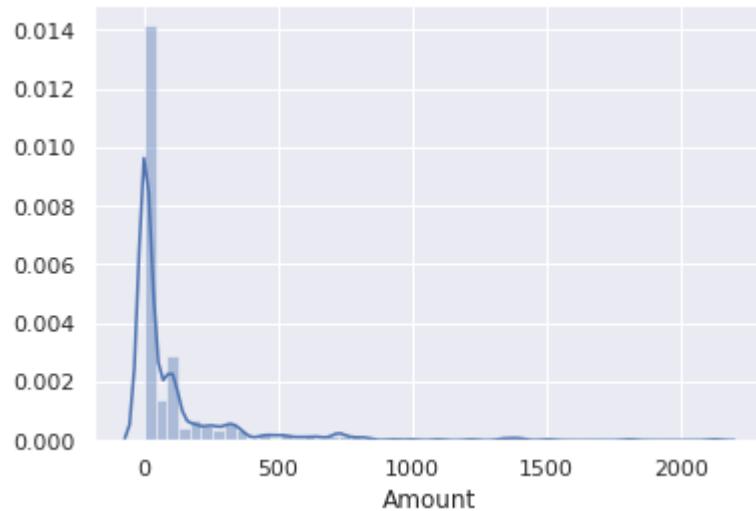


The time distribution also confirms what the dataset told us. The data includes two days' worth of data where there are more credit card transactions during the day and fewer at night.

Question: What does this distribution look like for fraud cases for the `Amount` column?

```
In [18]: sns.distplot(df[df['Class'] == 1]['Amount'])
```

```
Out[18]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd9834eea90>
```



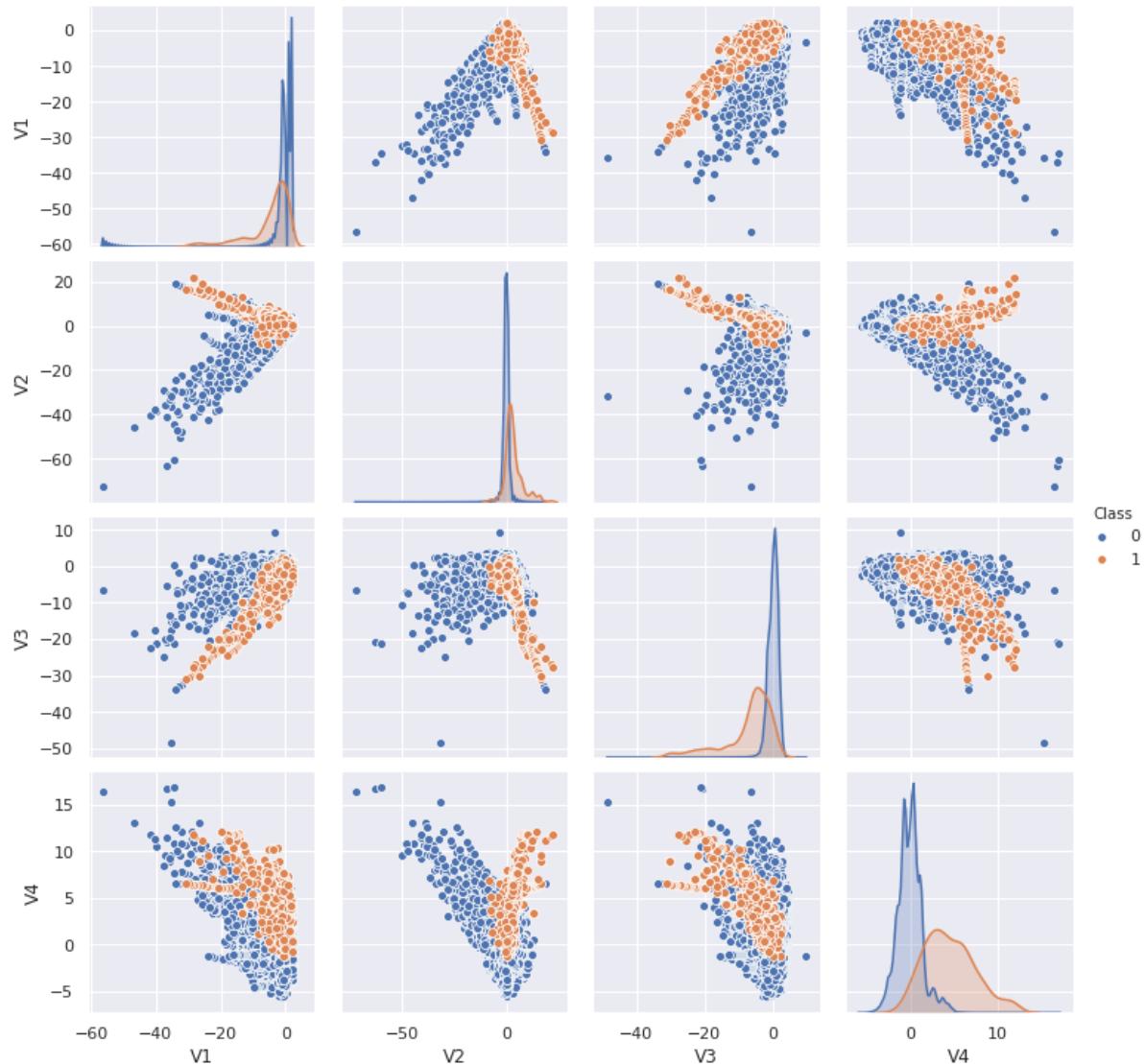
Now let's look at a distribution using a Seaborn function called `pairplot`. `pairplot` creates a grid of scatterplots, such that each feature in the dataset is used once as the X-axis and once as the Y-axis. The diagonal of this grid shows a distribution of the data for that feature.

Look at `V1` , `V2` , `V3` , `V4` , and `Class` pairplots. What do you see in the plots? Can you differentiate the fraud and not fraud from these features?

Hint: Create a new dataframe with columns `V1` , `V2` , `V3` , `V4` , and `Class` .

```
In [19]: new_df = df[['V1', 'V2', 'V3', 'V4', 'Class']]
sns.pairplot(new_df, hue="Class")
```

Out[19]: <seaborn.axisgrid.PairGrid at 0x7fd9833bcbe0>

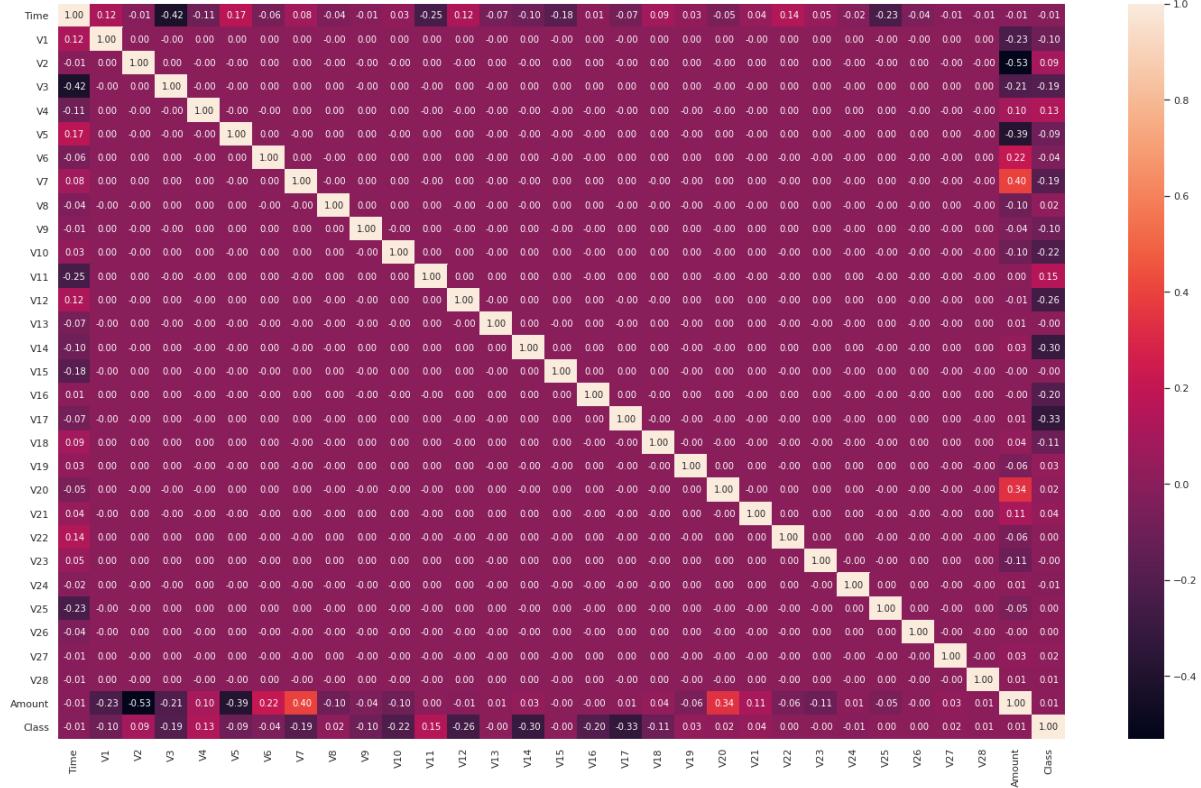


You can see for the smaller subset of the features that we used, there is a way to differentiate the fraud and not fraud, but it's not easy to separate it based on any one feature.

Now, let's look at how these features interact with each other. Use the Pandas `corr` function to calculate the linear correlations between the features of the dataset. It is always easier to visualize the correlation. Plot the correlation using the Seaborn heatmap (`sns.heatmap`) function with the `annot` flag set to `True`.

```
In [20]: plt.figure(figsize = (25,15))
correlation_matrix = df.corr()
sns.heatmap(correlation_matrix, annot=True, fmt=".2f")
```

Out[20]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd982948eb8>



Question: For correlated features, you should remove one of them before model training. Do you see any features that you can remove?

Answer: There aren't any correlated features to be removed.

Step 3: Model training and evaluation

There are some preliminary steps that you have to include when converting the dataset from a DataFrame to a format that a machine learning algorithm can use. For Amazon SageMaker, here are the steps you need to take:

1. Split the data into `train_data`, `validation_data`, and `test_data` using `sklearn.model_selection.train_test_split`.
2. Convert the dataset to an appropriate file format that the Amazon SageMaker training job can use. This can be either a CSV file or record protobuf. For more information, see [Common Data Formats for Training](https://docs.aws.amazon.com/sagemaker/latest/dg/cdf-training.html) (<https://docs.aws.amazon.com/sagemaker/latest/dg/cdf-training.html>).
3. Upload the data to your Amazon S3 bucket.

Use the following cells to complete these steps. Insert and delete cells where needed.

Project presentation: Take note of the key decisions you've made in this phase in your project presentations.

- The Amazon Simple Storage Service (Amazon S3) bucket and prefix(?) that you want to use for training and model data. This should be within the same Region as the Notebook Instance, training, and hosting.
- The AWS Identity and Access Management (IAM) role [Amazon Resource Name \(ARN\)](https://docs.aws.amazon.com/general/latest/gr/aws-arns-and-namespaces.html) (<https://docs.aws.amazon.com/general/latest/gr/aws-arns-and-namespaces.html>) used to give training and hosting access to your data. See the documentation for how to create these.

Note: If more than one role is required for notebook instances, training, and/or hosting, replace the `get_execution_role()` call with the appropriate full IAM role ARN string(s).

Replace `<LabBucketName>` with the resource name that was provided with your lab account.

```
In [21]: import boto3
import sagemaker
from sagemaker import get_execution_role
from sagemaker.amazon.amazon_estimator import image_uris
from sagemaker.amazon.amazon_estimator import RecordSet

# Instantiate an Amazon SageMaker session
sess = sagemaker.Session()

# Get the Amazon SageMaker role
role = get_execution_role()

# Bucket name
bucket = 'ml-pipeline-bucket'

# Get the image URI for the container that includes the Linear Learner algorithm
container = image_uris.retrieve('linear-learner',boto3.Session().region_name)

print(f'Session {sess}')
print(f'The role is {role}')
print(f'The container is {role} in the {boto3.Session().region_name} region')
```

```
Session <sagemaker.session.Session object at 0x7fd97efb57f0>
The role is arn:aws:iam::630754909290:role/qls-163755-da83bcc05bd75b-SageMakerNotebookInstanc-10U6LSBH12ML8
The container is arn:aws:iam::630754909290:role/qls-163755-da83bcc05bd75b-SageMakerNotebookInstanc-10U6LSBH12ML8 in the us-west-2 region
```

```
In [22]: import numpy as np
from sklearn.model_selection import train_test_split

def create_training_sets(data):
    """
    Convert data frame to train, validation and test
    params:
        data: The dataframe with the dataset to be split
    Returns:
        train_features: Training feature dataset
        test_features: Test feature dataset
        train_labels: Labels for the training dataset
        test_labels: Labels for the test dataset
        val_features: Validation feature dataset
        val_labels: Labels for the validation dataset
    """
    # Extract the target variable from the dataframe and convert the type to float32
    ys = np.array(data["Class"]).astype("float32")

    # Drop all the unwanted columns including the target column
    drop_list = ["Class", "Time"]

    # Drop the columns from the drop_list and convert the data into a NumPy array of type float32
    xs = np.array(data.drop(drop_list, axis=1)).astype("float32")

    np.random.seed(0)

    # Use the sklearn function train_test_split to split the dataset in the ratio train 80% and test 20%
    train_features, test_features, \
    train_labels, test_labels = train_test_split(xs, ys, test_size=0.2)

    # Use the sklearn function again to split the test dataset into 50% validation and 50% test
    val_features, test_features, \
    val_labels, test_labels = train_test_split(test_features, test_labels, test_size=0.5)

    return train_features, test_features, train_labels, test_labels, val_features, val_labels
```

```
In [23]: # Use the function to create your datasets
train_features, test_features, train_labels, test_labels, val_features, val_labels = create_training_sets(df)

print(f"Length of train_features is: {train_features.shape}")
print(f"Length of train_labels is: {train_labels.shape}")
print(f"Length of val_features is: {val_features.shape}")
print(f"Length of val_labels is: {val_labels.shape}")
print(f"Length of test_features is: {test_features.shape}")
print(f"Length of test_labels is: {test_labels.shape}")

Length of train_features is: (227845, 29)
Length of train_labels is: (227845,)
Length of val_features is: (28481, 29)
Length of val_labels is: (28481,)
Length of test_features is: (28481, 29)
Length of test_labels is: (28481,)
```

Model training

Lets start by instantiating the LinearLearner estimator with `predictor_type='binary_classifier'` parameter with one `ml.m4.xlarge` instance.

```
In [24]: import sagemaker
from sagemaker.amazon.amazon_estimator import RecordSet
import boto3

# Instantiate the LinearLearner estimator object
num_classes = len(pd.unique(train_labels))

# Instantiate the LinearLearner estimator 'binary classifier' object with one
# ml.m4.xlarge instance
linear = sagemaker.LinearLearner(role=sagemaker.get_execution_role(),
                                  instance_count=1,
                                  instance_type='ml.m4.xlarge',
                                  predictor_type='binary_classifier')
```

Linear learner accepts training data in protobuf or CSV content types, and accepts inference requests in protobuf, CSV, or JSON content types. Training data has features and ground-truth labels, while the data in an inference request has only features. In a production pipeline, it is recommended to convert the data to the Amazon SageMaker protobuf format and store it in Amazon S3. However, to get up and running quickly, AWS provides the convenient method `record_set` for converting and uploading when the dataset is small enough to fit in local memory. It accepts NumPy arrays like the ones you already have, so let's use it here. The `RecordSet` object will keep track of the temporary Amazon S3 location of your data. Use the `estimator.record_set` function to create train, validation, and test records. Then, use the `estimator.fit` function to start your training job.

```
In [25]: ### Create train, val, test records
train_records = linear.record_set(train_features, train_labels, channel='train')
val_records = linear.record_set(val_features, val_labels, channel='validation')
test_records = linear.record_set(test_features, test_labels, channel='test')
```

Now, lets train your model on the dataset that you just uploaded.

In [26]: *### Fit the classifier*

```
linear.fit([train_records,val_records,test_records], wait=True, logs='All')
```

Defaulting to the only supported framework/algorithm version: 1. Ignoring framework/algorithm version: 1.

Defaulting to the only supported framework/algorithm version: 1. Ignoring framework/algorithm version: 1.

```
2020-11-11 14:44:44 Starting - Starting the training job...
2020-11-11 14:44:46 Starting - Launching requested ML instances.....
2020-11-11 14:45:55 Starting - Preparing the instances for training.....
2020-11-11 14:47:10 Downloading - Downloading input data
2020-11-11 14:47:10 Training - Downloading the training image.....
2020-11-11 14:48:03 Training - Training image download completed. Training in
progress.Docker entrypoint called with argument(s): train
Running default environment configuration script
[11/11/2020 14:48:07 INFO 139746054510400] Reading default configuration from
/opt/amazon/lib/python2.7/site-packages/algorithm/resources/default-input.json
n: {u'loss_insensitivity': u'0.01', u'epochs': u'15', u'feature_dim': u'aut
o', u'init_bias': u'0.0', u'lr_scheduler_factor': u'auto', u'num_calibration_
samples': u'10000000', u'accuracy_top_k': u'3', u'_num_kv_servers': u'auto',
u'use_bias': u'true', u'num_point_for_scaler': u'10000', u'_log_level': u'in
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mum_lr': u'auto', u'target_recall': u'0.8', u'num_models': u'auto', u'early_s
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u'_enable_profiler': u>false', u'normalize_label': u'auto', u'_num_gpus':
u'auto', u'balance_multiclass_weights': u>false', u'positive_example_weight_
mult': u'1.0', u'l1': u'auto', u'margin': u'1.0'}
[11/11/2020 14:48:07 INFO 139746054510400] Merging with provided configuratio
n from /opt/ml/input/config/hyperparameters.json: {u'feature_dim': u'29', u'm
ini_batch_size': u'1000', u'predictor_type': u'binary_classifier'}
[11/11/2020 14:48:07 INFO 139746054510400] Final configuration: {u'loss_insen
sitivity': u'0.01', u'epochs': u'15', u'feature_dim': u'29', u'init_bias':
u'0.0', u'lr_scheduler_factor': u'auto', u'num_calibration_samples': u'10000
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u'_num_gpus': u'auto', u'balance_multiclass_weights': u>false', u'positive_e
xample_weight_mult': u'1.0', u'l1': u'auto', u'margin': u'1.0'}
[11/11/2020 14:48:07 WARNING 139746054510400] Loggers have already been setu
p.
Process 1 is a worker.
[11/11/2020 14:48:07 INFO 139746054510400] Using default worker.
[11/11/2020 14:48:07 INFO 139746054510400] Checkpoint loading and saving are
```

```

disabled.

[2020-11-11 14:48:07.884] [tensorio] [warning] TensorIO is already initialized; ignoring the initialization routine.
[2020-11-11 14:48:07.890] [tensorio] [warning] TensorIO is already initialized; ignoring the initialization routine.
[2020-11-11 14:48:07.934] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 0, "duration": 54, "num_examples": 1, "num_bytes": 164000}
[11/11/2020 14:48:07 INFO 139746054510400] Create Store: local
[2020-11-11 14:48:08.040] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 1, "duration": 104, "num_examples": 11, "num_bytes": 1804000}
[11/11/2020 14:48:08 INFO 139746054510400] Scaler algorithm parameters
<algorithm.scaler.ScalerAlgorithmStable object at 0x7f18ca60c750>
[11/11/2020 14:48:08 INFO 139746054510400] Scaling model computed with parameters:
{'stdev_weight':
[ 1.8716316   1.5564123   1.4980593   1.4006146   1.3107718
  1.2942092   1.2217906   1.142631    1.0924087   1.088866
  1.023216    1.0185932   1.000985   0.9616748   0.911602
  0.887076    0.86123973  0.8474177   0.81096953  0.70251316
  0.6751274   0.7168965   0.62883997  0.60341674  0.51704824
  0.48686436  0.3915909   0.28414798  249.32236   ]
<NDArray 29 @cpu(0)>, 'stdev_label': None, 'mean_label': None, 'mean_weight':
[ 1.7117597e-02  2.1779669e-02 -3.5191043e-03  1.3411363e-02
 -2.2384234e-02 -1.2276539e-02  5.5785407e-03  2.8708936e-03
  3.1419462e-03  2.9730159e-03  4.6970514e-03  1.8109744e-03
 -5.9388764e-03  3.7719631e-03 -2.8922176e-03 -6.1020884e-03
  9.2713684e-03 -3.7594694e-03 -1.4632845e-02  1.4668558e-02
  1.3560429e-03 -4.5494209e-03 -2.3624380e-03 -3.4353272e-03
 -2.0532920e-03 -3.9219833e-04 -8.7902183e-05 -2.2155168e-03
  9.0184189e+01]
<NDArray 29 @cpu(0)>}
[11/11/2020 14:48:08 INFO 139746054510400] nvidia-smi took: 0.0252459049225 seconds to identify 0 gpus
[11/11/2020 14:48:08 INFO 139746054510400] Number of GPUs being used: 0
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 11, "sum": 11.0, "min": 11}, "Number of Batches Since Last Reset": {"count": 1, "max": 0, "sum": 0.0, "min": 0}, "Number of Records Since Last Reset": {"count": 1, "max": 0, "sum": 0.0, "min": 0}, "Total Batches Seen": {"count": 1, "max": 12, "sum": 12.0, "min": 12}, "Total Records Seen": {"count": 1, "max": 12000, "sum": 12000.0, "min": 12000}, "Max Records Seen Between Resets": {"count": 1, "max": 11000, "sum": 11000.0, "min": 11000}, "Reset Count": {"count": 1, "max": 2, "sum": 2.0, "min": 2}}, "EndTime": 1605106088.150717, "Dimensions": {"Host": "algo-1", "Meta": "init_train_data_iter", "Operation": "training", "Algorithm": "Linear Learner"}, "StartTime": 1605106088.150668}

[2020-11-11 14:48:15.479] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 3, "duration": 7327, "num_examples": 228, "num_bytes": 37366580}
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```

```
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```

```
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```

```
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {
    "count": 1, "max": 0.019442903531707068, "sum": 0.019442903531707068, "min": 0.019442903531707068}}, "EndTime": 1605106095.481365, "Dimensions": {"model": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106095.481348}

[11/11/2020 14:48:15 INFO 139746054510400] #quality_metric: host=algo-1, epoch=0, train binary_classification_cross_entropy_objective <loss>=0.108294499393
[2020-11-11 14:48:15.502] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 0, "duration": 7617, "num_examples": 1, "num_bytes": 164000}
[2020-11-11 14:48:16.286] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 2, "duration": 784, "num_examples": 29, "num_bytes": 4670884}
#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.021203791231700724, "sum": 0.021203791231700724, "min": 0.021203791231700724}}, "EndTime": 1605106097.083544, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106097.083392}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.01900208280568779, "sum": 0.01900208280568779, "min": 0.01900208280568779}}, "EndTime": 1605106097.083698, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106097.083673}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.02121634185492065, "sum": 0.02121634185492065, "min": 0.02121634185492065}}, "EndTime": 1605106097.083818, "Dimensions": {"model": 2, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106097.083753}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.01901948279968821, "sum": 0.01901948279968821, "min": 0.01901948279968821}}, "EndTime": 1605106097.083903, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106097.083883}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.004886939356737327, "sum": 0.004886939356737327, "min": 0.004886939356737327}}, "EndTime": 1605106097.08401, "Dimensions": {"model": 4, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106097.083989}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005285729759132329, "sum": 0.005285729759132329, "min": 0.005285729759132329}}, "EndTime": 1605106097.084201, "Dimensions": {"model": 6, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106097.084179}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.004840211682697849, "sum": 0.004840211682697849, "min": 0.004840211682697849}}, "EndTime": 1605106097.084275, "Dimensions": {"model": 7, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106097.084257}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.021248924962833295, "sum": 0.021248924962833295, "min": 0.021248924962833295}}, "EndTime": 1605106097.084378, "Dimensions": {"model": 8, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106097.084357}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.02603277499277033, "sum": 0.02603277499277033, "min": 0.02603277499277033}}, "EndTime": 1605106097.085237, "Dimensions": {"model": 18, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106097.085218}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.014085664913554794, "sum": 0.014085664913554794, "min": 0.014085664913554794}}, "EndTime": 1605106097.085595, "Dimensions": {"model": 22, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106097.085551}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.013969619636358847, "sum": 0.013969619636358847, "min": 0.013969619636358847}}, "EndTime": 1605106097.086238, "Dimensions": {"model": 30, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106097.086191}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.013981296751531907, "sum": 0.013981296751531907, "min": 0.013981296751531907}}, "EndTime": 1605106097.086307, "Dimensions": {"model": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106097.086289}
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[11/11/2020 14:48:17 INFO 139746054510400] #quality_metric: host=algo-1, epoch=0, validation_binary_classification_cross_entropy_objective <loss>=0.0212037912317
[11/11/2020 14:48:17 INFO 139746054510400] #early_stopping_criteria_metric: host=algo-1, epoch=0, criteria=sampled_accuracy, value=0.999438221973
```

```
[11/11/2020 14:48:17 INFO 139746054510400] Epoch 0: Loss improved. Updating best model
[11/11/2020 14:48:17 INFO 139746054510400] Saving model for epoch: 0
[11/11/2020 14:48:17 INFO 139746054510400] Saved checkpoint to "/tmp/tmpJAbZE/mx-mod-0000.params"
[11/11/2020 14:48:17 INFO 139746054510400] #progress_metric: host=algo-1, completed 6 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Batches Since Last Reset": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Records Since Last Reset": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Total Batches Seen": {"count": 1, "max": 240, "sum": 240.0, "min": 240}, "Total Records Seen": {"count": 1, "max": 239845, "sum": 239845.0, "min": 239845}, "Max Records Seen Between Resets": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Reset Count": {"count": 1, "max": 3, "sum": 3.0, "min": 3}}, {"EndTime": 1605106097.098184, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106088.151018}

[11/11/2020 14:48:17 INFO 139746054510400] #throughput_metric: host=algo-1, train throughput=25465.2358032 records/second
[2020-11-11 14:48:24.501] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 5, "duration": 7400, "num_examples": 228, "num_bytes": 37366580}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005634534616958727, "sum": 0.005634534616958727, "min": 0.005634534616958727}, "EndTime": 1605106104.502466, "Dimensions": {"model": 4, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106104.502447}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.019238672432920483, "sum": 0.019238672432920483, "min": 0.019238672432920483}}, "EndTime": 1605106104.503259, "Dimensions": {"model": 16, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106104.503241}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.0192402909064608, "sum": 0.0192402909064608, "min": 0.0192402909064608}}, "EndTime": 1605106104.503388, "Dimensions": {"model": 18, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106104.50337}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.017591321485158105, "sum": 0.017591321485158105, "min": 0.017591321485158105}}, "EndTime": 1605106104.503451, "Dimensions": {"model": 19, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106104.503433}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.011684707636350052, "sum": 0.011684707636350052, "min": 0.011684707636350052}}, "EndTime": 1605106104.503513, "Dimensions": {"model": 20, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106104.503496}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.011693558342656375, "sum": 0.011693558342656375, "min": 0.011693558342656375}}, "EndTime": 1605106104.503643, "Dimensions": {"model": 22, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106104.503625}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.011727315062468272, "sum": 0.011727315062468272, "min": 0.011727315062468272}}, "EndTime": 1605106104.503698, "Dimensions": {"model": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106104.503682}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.01845147640379515, "sum": 0.01845147640379515, "min": 0.01845147640379515}, "EndTime": 1605106104.503939, "Dimensions": {"model": 27, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106104.503921}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.012636458701499233, "sum": 0.012636458701499233, "min": 0.012636458701499233}, "EndTime": 1605106104.504009, "Dimensions": {"model": 28, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106104.50399}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.012642456470607136, "sum": 0.012642456470607136, "min": 0.012642456470607136}, "EndTime": 1605106104.504069, "Dimensions": {"model": 29, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106104.504053}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.012636391425447842, "sum": 0.012636391425447842, "min": 0.012636391425447842}, "EndTime": 1605106104.504113, "Dimensions": {"model": 30, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106104.504113}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.01264300325631045, "sum": 0.01264300325631045, "min": 0.01264300325631045}, "EndTime": 1605106104.504191, "Dimensions": {"model": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106104.504174}

[11/11/2020 14:48:24 INFO 139746054510400] #quality_metric: host=algo-1, epoch=1, train binary_classification_cross_entropy_objective <loss>=0.0148098821136
[2020-11-11 14:48:25.248] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 5, "duration": 726, "num_examples": 29, "num_bytes": 4670884}
#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.01062747600151328, "sum": 0.01062747600151328, "mi

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.009022429068015451, "sum": 0.009022429068015451, "min": 0.009022429068015451}}, "EndTime": 1605106105.760722, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.7607}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.010632775271107552, "sum": 0.010632775271107552, "min": 0.010632775271107552}}, "EndTime": 1605106105.760789, "Dimensions": {"model": 2, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.760771}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.004833605354042612, "sum": 0.004833605354042612, "min": 0.004833605354042612}}, "EndTime": 1605106105.760992, "Dimensions": {"model": 5, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.760975}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.004989081256188125, "sum": 0.004989081256188125, "min": 0.004989081256188125}}, "EndTime": 1605106105.761044, "Dimensions": {"model": 6, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.761033}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.004462796381541063, "sum": 0.004462796381541063, "min": 0.004462796381541063}}, "EndTime": 1605106105.761097, "Dimensions": {"model": 7, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.761081}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.010773927282028865, "sum": 0.010773927282028865, "min": 0.010773927282028865}}, "EndTime": 1605106105.761162, "Dimensions": {"model": 8, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.761145}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.009172993778475072, "sum": 0.009172993778475072, "min": 0.009172993778475072}}, "EndTime": 1605106105.761221, "Dimensions": {"model": 9, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.010786104183853989, "sum": 0.010786104183853989, "min": 0.010786104183853989}}, "EndTime": 1605106105.761275, "Dimensions": {"model": 10, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.761261}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.009169605766838302, "sum": 0.009169605766838302, "min": 0.009169605766838302}}, "EndTime": 1605106105.761332, "Dimensions": {"model": 11, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.761316}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.004799836160577351, "sum": 0.004799836160577351, "min": 0.004799836160577351}}, "EndTime": 1605106105.761404, "Dimensions": {"model": 12, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.761386}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.004829027498209143, "sum": 0.004829027498209143, "min": 0.004829027498209143}}, "EndTime": 1605106105.76147, "Dimensions": {"model": 13, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.761451}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.00471898017984893, "sum": 0.00471898017984893, "min": 0.00471898017984893}}, "EndTime": 1605106105.761545, "Dimensions": {"model": 14, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.761526}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.004810821105538072, "sum": 0.004810821105538072, "min": 0.004810821105538072}}, "EndTime": 1605106105.76161, "Dimensions": {"model": 15, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.761592}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.01684860322445381, "sum": 0.01684860322445381, "min": 0.01684860322445381}}, "EndTime": 1605106105.761682, "Dimensions": {"model": 16, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.761664}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.015369988036940077, "sum": 0.015369988036940077, "min": 0.015369988036940077}}, "EndTime": 1605106105.761747, "Dimensions": {"model": 17, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.76173}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.01683700131983248, "sum": 0.01683700131983248, "min": 0.01683700131983248}}, "EndTime": 1605106105.761811, "Dimensions": {"model": 18, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.761793}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.015450112266590085, "sum": 0.015450112266590085, "min": 0.015450112266590085}, "EndTime": 1605106105.761872, "Dimensions": {"model": 19, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.761857}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.0141842980669613, "sum": 0.0141842980669613, "min": 0.0141842980669613}, "EndTime": 1605106105.761925, "Dimensions": {"model": 20, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.761913}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.014574350330803754, "sum": 0.014574350330803754, "min": 0.014574350330803754}, "EndTime": 1605106105.761979, "Dimensions": {"model": 21, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.761967}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.014268879713643313, "sum": 0.014268879713643313, "min": 0.014268879713643313}, "EndTime": 1605106105.762022, "Dimensions": {"model": 22, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.762008}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.01482256719275081, "sum": 0.01482256719275081, "min": 0.01482256719275081}, "EndTime": 1605106105.762082, "Dimensions": {"model": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.762065}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.017722567197358288, "sum": 0.017722567197358288, "min": 0.017722567197358288}, "EndTime": 1605106105.762152, "Dimensions": {"model": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.762134}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.01646281294907911, "sum": 0.01646281294907911, "min": 0.01646281294907911}, "EndTime": 1605106105.762218, "Dimensions": {"model": 25, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.762222}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.017724362540071772, "sum": 0.017724362540071772, "min": 0.017724362540071772}, "EndTime": 1605106105.762279, "Dimensions": {"model": 26, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.762263}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.016464737692951113, "sum": 0.016464737692951113, "min": 0.016464737692951113}, "EndTime": 1605106105.762342, "Dimensions": {"model": 27, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.762326}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.013972276641949104, "sum": 0.013972276641949104,
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    "min": 0.013972276641949104}], "EndTime": 1605106105.7624, "Dimensions": {"model": 28, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.762383}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.013962019046937342, "sum": 0.013962019046937342, "min": 0.013962019046937342}, "EndTime": 1605106105.762461, "Dimensions": {"model": 29, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.762449}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.013975898141560606, "sum": 0.013975898141560606, "min": 0.013975898141560606}, "EndTime": 1605106105.762512, "Dimensions": {"model": 30, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.762495}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.013974543924701, "sum": 0.013974543924701, "min": 0.013974543924701}, "EndTime": 1605106105.762576, "Dimensions": {"model": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106105.762558}

[11/11/2020 14:48:25 INFO 139746054510400] #quality_metric: host=algo-1, epoch=1, validation_binary_classification_cross_entropy_objective <loss>=0.0106274760015
[11/11/2020 14:48:25 INFO 139746054510400] #early_stopping_criteria_metric: host=algo-1, epoch=1, criteria=sampled_accuracy, value=0.999473333099
[11/11/2020 14:48:25 INFO 139746054510400] Epoch 1: Loss improved. Updating best model
[11/11/2020 14:48:25 INFO 139746054510400] Saving model for epoch: 1
[11/11/2020 14:48:25 INFO 139746054510400] Saved checkpoint to "/tmp/tmp7sv9v1/mx-mod-0000.params"
[11/11/2020 14:48:25 INFO 139746054510400] #progress_metric: host=algo-1, completed 13 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Batches Since Last Reset": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Records Since Last Reset": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Total Batches Seen": {"count": 1, "max": 468, "sum": 468.0, "min": 468}, "Total Records Seen": {"count": 1, "max": 467690, "sum": 467690.0, "min": 467690}, "Max Records Seen Between Resets": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Reset Count": {"count": 1, "max": 4, "sum": 4.0, "min": 4}, "EndTime": 1605106105.769465, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106097.100892}

[11/11/2020 14:48:25 INFO 139746054510400] #throughput_metric: host=algo-1, train throughput=26283.5804845 records/second
[2020-11-11 14:48:32.981] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 7, "duration": 7209, "num_examples": 228, "num_bytes": 37366580}
#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.009248955949287582, "sum": 0.009248955949287582, "min": 0.009248955949287582}, "EndTime": 1605106112.981189, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605106112.981076}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.007770386974191875, "sum": 0.007770386974191875, "min": 0.007770386974191875}, "EndTime": 1605106112.981299, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605106112.981282}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.009251673372831639, "sum": 0.009251673372831639, "min": 0.009251673372831639}, "EndTime": 1605106112.981352, "Dimensions": {"model": 2, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605106112.981339}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005396935052020959, "sum": 0.005396935052020959, "min": 0.005396935052020959}, "EndTime": 1605106112.981451, "Dimensions": {"model": 4, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605106112.981439}

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[2020-11-11 14:48:33.820] [tensorio] [info] epoch_stats={"data_pipeline": "/o
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[11/11/2020 14:48:34 INFO 139746054510400] #quality_metric: host=algo-1, epoch=2, validation_binary_classification_cross_entropy_objective <loss>=0.00773676629356
[11/11/2020 14:48:34 INFO 139746054510400] #early_stopping_criteria_metric: host=algo-1, epoch=2, criteria=sampled_accuracy, value=0.999473333099
[11/11/2020 14:48:34 INFO 139746054510400] Epoch 2: Loss improved. Updating best model

```

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[11/11/2020 14:48:34 INFO 139746054510400] Saving model for epoch: 2
[11/11/2020 14:48:34 INFO 139746054510400] Saved checkpoint to "/tmp/tmpwlzbz
0/mx-mod-0000.params"
[11/11/2020 14:48:34 INFO 139746054510400] #progress_metric: host=algo-1, com
pleted 20 % of epochs
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[11/11/2020 14:48:34 INFO 139746054510400] #throughput_metric: host=algo-1, t
rain throughput=26620.5593773 records/second
[2020-11-11 14:48:41.046] [tensorio] [info] epoch_stats={"data_pipeline": "/o
pt/ml/input/data/train", "epoch": 9, "duration": 6714, "num_examples": 228,
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005822353831734426, "sum": 0.005822353831734426, "min": 0.005822353831734426}}, "EndTime": 1605106121.04722, "Dimensions": {"model": 14, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106121.047203}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.013143481821740776, "sum": 0.013143481821740776, "min": 0.013143481821740776}}, "EndTime": 1605106121.047346, "Dimensions": {"model": 16, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106121.047329}

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[11/11/2020 14:48:41 INFO 139746054510400] #quality_metric: host=algo-1, epoch=3, train binary_classification_cross_entropy_objective <loss>=0.00734370374575
[2020-11-11 14:48:41.879] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 11, "duration": 812, "num_examples": 29, "num_bytes": 4670884}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.004147249677765466, "sum": 0.004147249677765466, "min": 0.004147249677765466}}, "EndTime": 1605106122.366044, "Dimensions": {"model": 6, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106122.366033}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.006815345927464452, "sum": 0.006815345927464452, "min": 0.006815345927464452}}, "EndTime": 1605106122.366153, "Dimensions": {"model": 8, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106122.366138}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005693656721584232, "sum": 0.005693656721584232, "min": 0.005693656721584232}}, "EndTime": 1605106122.366219, "Dimensions": {"model": 9, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106122.366202}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.006822434010279153, "sum": 0.006822434010279153, "min": 0.006822434010279153}}, "EndTime": 1605106122.366289, "Dimensions": {"model": 10, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106122.366272}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.004946328891863511, "sum": 0.004946328891863511, "min": 0.004946328891863511}}, "EndTime": 1605106122.36644, "Dimensions": {"model": 12, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106122.366421}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.004844516969866424, "sum": 0.004844516969866424, "min": 0.004844516969866424}}, "EndTime": 1605106122.366515, "Dimensions": {"model": 13, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106122.366497}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.004818129146464491, "sum": 0.004818129146464491, "min": 0.004818129146464491}}, "EndTime": 1605106122.366655, "Dimensions": {"model": 15, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106122.366636}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.013843641384595281, "sum": 0.013843641384595281, "min": 0.013843641384595281}}, "EndTime": 1605106122.366729, "Dimensions": {"model": 16, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106122.36671}

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[11/11/2020 14:48:42 INFO 139746054510400] #quality_metric: host=algo-1, epoch=3, validation_binary_classification_cross_entropy_objective <loss>=0.00646122672376
[11/11/2020 14:48:42 INFO 139746054510400] #early_stopping_criteria_metric: host=algo-1, epoch=3, criteria=sampled_accuracy, value=0.999473333099
[11/11/2020 14:48:42 INFO 139746054510400] Epoch 3: Loss improved. Updating best model
[11/11/2020 14:48:42 INFO 139746054510400] Saving model for epoch: 3
[11/11/2020 14:48:42 INFO 139746054510400] Saved checkpoint to "/tmp/tmpqFHiu/_mx-mod-0000.params"
[11/11/2020 14:48:42 INFO 139746054510400] #progress_metric: host=algo-1, completed 26 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Batches Since Last Reset": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Records Since Last Reset": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Total Batches Seen": {"count": 1, "max": 924, "sum": 924.0, "min": 924}, "Total Records Seen": {"count": 1, "max": 923380, "sum": 923380.0, "min": 923380}, "Max Records Seen Between Resets": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Reset Count": {"count": 1, "max": 6, "sum": 6.0, "min": 6}, "EndTime": 1605106122.374234, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106114.331748}

[11/11/2020 14:48:42 INFO 139746054510400] #throughput_metric: host=algo-1, train throughput=28329.6844528 records/second
[2020-11-11 14:48:49.268] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 11, "duration": 6892, "num_examples": 228, "num_bytes": 37366580}
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[11/11/2020 14:48:49 INFO 139746054510400] #quality_metric: host=algo-1, eop
h=4, train binary_classification_cross_entropy_objective <loss>=0.00642198115
508
[2020-11-11 14:48:50.116] [tensorio] [info] epoch_stats={"data_pipeline": "/o
pt/ml/input/data/validation", "epoch": 14, "duration": 825, "num_examples": 2
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[11/11/2020 14:48:50 INFO 139746054510400] #quality_metric: host=algo-1, epoch=4, validation_binary_classification_cross_entropy_objective <loss>=0.00576566489182
[11/11/2020 14:48:50 INFO 139746054510400] #early_stopping_criteria_metric: host=algo-1, epoch=4, criteria=sampled_accuracy, value=0.999473333099
[11/11/2020 14:48:50 INFO 139746054510400] Epoch 4: Loss improved. Updating best model
[11/11/2020 14:48:50 INFO 139746054510400] Saving model for epoch: 4
[11/11/2020 14:48:50 INFO 139746054510400] Saved checkpoint to "/tmp/tmpj1HI4

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x/mx-mod-0000.params"
[11/11/2020 14:48:50 INFO 139746054510400] #progress_metric: host=algo-1, completed 33 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Batches Since Last Reset": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Records Since Last Reset": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Total Batches Seen": {"count": 1, "max": 1152, "sum": 1152.0, "min": 1152}, "Total Records Seen": {"count": 1, "max": 1151225, "sum": 1151225.0, "min": 1151225}, "Max Records Seen Between Resets": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Reset Count": {"count": 1, "max": 7, "sum": 7.0, "min": 7}}, "EndTime": 1605106130.635369, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605106122.375896}

[11/11/2020 14:48:50 INFO 139746054510400] #throughput_metric: host=algo-1, train throughput=27585.4462895 records/second
[2020-11-11 14:48:58.106] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 13, "duration": 7469, "num_examples": 228, "num_bytes": 37366580}
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[11/11/2020 14:48:58 INFO 139746054510400] #quality_metric: host=algo-1, epoc
h=5, train binary_classification_cross_entropy_objective <loss>=0.00589422865
481
[2020-11-11 14:48:58.930] [tensorio] [info] epoch_stats={"data_pipeline": "/o
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9, "num_bytes": 4670884}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.01396974335769552, "sum": 0.01396974335769552, "min": 0.01396974335769552}, "EndTime": 1605106139.426212, "Dimensions": {"model": 30, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 5}, "StartTime": 1605106139.426197}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.013921301467277785, "sum": 0.013921301467277785, "min": 0.013921301467277785}, "EndTime": 1605106139.426274, "Dimensions": {"model": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 5}, "StartTime": 1605106139.426258}

[11/11/2020 14:48:59 INFO 139746054510400] #quality_metric: host=algo-1, epoch=5, validation_binary_classification_cross_entropy_objective <loss>=0.00533731844455
[11/11/2020 14:48:59 INFO 139746054510400] #early_stopping_criteria_metric: host=algo-1, epoch=5, criteria=sampled_accuracy, value=0.999508444226
[11/11/2020 14:48:59 INFO 139746054510400] Epoch 5: Loss improved. Updating best model
[11/11/2020 14:48:59 INFO 139746054510400] Saving model for epoch: 5
[11/11/2020 14:48:59 INFO 139746054510400] Saved checkpoint to "/tmp/tmpdmNcNu/mx-mod-0000.params"
[11/11/2020 14:48:59 INFO 139746054510400] #progress_metric: host=algo-1, completed 40 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Batches Since Last Reset": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Records Since Last Reset": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Total Batches Seen": {"count": 1, "max": 1380, "sum": 1380.0, "min": 1380}, "Total Records Seen": {"count": 1, "max": 1379070, "sum": 1379070.0, "min": 1379070}, "Max Records Seen Between Resets": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Reset Count": {"count": 1, "max": 8, "sum": 8.0, "min": 8}, "EndTime": 1605106139.433002, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 5}, "StartTime": 1605106130.637225}

[11/11/2020 14:48:59 INFO 139746054510400] #throughput_metric: host=algo-1, train throughput=25903.5639123 records/second
[2020-11-11 14:49:07.065] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 15, "duration": 7630, "num_examples": 228, "num_bytes": 37366580}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.0061170417905378974, "sum": 0.0061170417905378974, "min": 0.0061170417905378974}}, "EndTime": 1605106147.066373, "Dimensions": {"model": 8, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605106147.066355}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.0053504794843921575, "sum": 0.0053504794843921575, "min": 0.0053504794843921575}}, "EndTime": 1605106147.066617, "Dimensions": {"model": 12, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605106147.066602}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.012121590077614468, "sum": 0.012121590077614468, "min": 0.012121590077614468}}, "EndTime": 1605106147.066863, "Dimensions": {"model": 16, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605106147.066847}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.011786926009581478, "sum": 0.011786926009581478, "min": 0.011786926009581478}}, "EndTime": 1605106147.066937, "Dimensions": {"model": 17, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605106147.066917}

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[11/11/2020 14:49:07 INFO 139746054510400] #quality_metric: host=algo-1, epoch=6, train binary_classification_cross_entropy_objective <loss>=0.00555910110579
[2020-11-11 14:49:07.867] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 20, "duration": 781, "num_examples": 29, "num_bytes": 4670884}
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[11/11/2020 14:49:08 INFO 139746054510400] #quality_metric: host=algo-1, epoch=6, validation_binary_classification_cross_entropy_objective <loss>=0.00505230375808
[11/11/2020 14:49:08 INFO 139746054510400] #early_stopping_criteria_metric: host=algo-1, epoch=6, criteria=sampled_accuracy, value=0.999508444226
[11/11/2020 14:49:08 INFO 139746054510400] Epoch 6: Loss improved. Updating best model
[11/11/2020 14:49:08 INFO 139746054510400] Saving model for epoch: 6
[11/11/2020 14:49:08 INFO 139746054510400] Saved checkpoint to "/tmp/tmpKTn6nu/mx-mod-0000.params"
[11/11/2020 14:49:08 INFO 139746054510400] #progress_metric: host=algo-1, com
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pleted 46 % of epochs
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[11/11/2020 14:49:08 INFO 139746054510400] #throughput_metric: host=algo-1, t
rain throughput=25540.5589095 records/second
[2020-11-11 14:49:15.710] [tensorio] [info] epoch_stats={"data_pipeline": "/o
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005332031587146978, "sum": 0.005332031587146978, "mi
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[11/11/2020 14:49:15 INFO 139746054510400] #quality_metric: host=algo-1, epoch=7, train binary_classification_cross_entropy_objective <loss>=0.005330935098
[2020-11-11 14:49:16.527] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 23, "duration": 794, "num_examples": 29, "num_bytes": 4670884}
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[11/11/2020 14:49:17 INFO 139746054510400] #quality_metric: host=algo-1, epoch=7, validation_binary_classification_cross_entropy_objective <loss>=0.00485240110566
[11/11/2020 14:49:17 INFO 139746054510400] #early_stopping_criteria_metric: host=algo-1, epoch=7, criteria=sampled_accuracy, value=0.999473333099
[11/11/2020 14:49:17 INFO 139746054510400] Epoch 7: Loss improved. Updating best model
[11/11/2020 14:49:17 INFO 139746054510400] Saving model for epoch: 7
[11/11/2020 14:49:17 INFO 139746054510400] Saved checkpoint to "/tmp/tmp3L5beL/mx-mod-0000.params"
[11/11/2020 14:49:17 INFO 139746054510400] #progress_metric: host=algo-1, completed 53 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Batches Since Last Reset": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Records Since Last Reset": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Total Batches Seen": {"count": 1, "max": 1836, "sum": 1836.0, "min": 1836}, "Total Records Seen": {"count": 1, "max": 1834760, "sum": 1834760.0, "min": 1834760}, "Max Records Seen Between Resets": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Reset Count": {"count": 1, "max": 10, "sum": 10.0, "min": 10}], "EndTime": 1605106157.016055, "Dimensions": {"Host": "algo-1", "Metric": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 7}, "StartTime": 1605106148.357241}

[11/11/2020 14:49:17 INFO 139746054510400] #throughput_metric: host=algo-1, train throughput=26313.321812 records/second
[2020-11-11 14:49:24.298] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 19, "duration": 7280, "num_examples": 228, "num_bytes": 37366580}
#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005167797521347516, "sum": 0.005167797521347516, "min": 0.005167797521347516}], "EndTime": 1605106164.29821, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 8}, "StartTime": 1605106164.298096}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.0044006099115384304, "sum": 0.0044006099115384304, "min": 0.0044006099115384304}, "EndTime": 1605106164.29845, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 8}, "StartTime": 1605106164.298433}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.004427994218823143, "sum": 0.004427994218823143, "min": 0.004427994218823143}, "EndTime": 1605106164.298518, "Dimensions": {"model": 4, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 8}, "StartTime": 1605106164.298499}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005785895287202843, "sum": 0.005785895287202843, "min": 0.005785895287202843}, "EndTime": 1605106164.298786, "Dimensions": {"model": 8, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 8}, "StartTime": 1605106164.298768}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005786941555628167, "sum": 0.005786941555628167, "min": 0.005786941555628167}, "EndTime": 1605106164.298919, "Dimensions": {"model": 10, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 8}, "StartTime": 1605106164.298902}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005665767960348843, "sum": 0.005665767960348843, "min": 0.005665767960348843}}, "EndTime": 1605106164.299121, "Dimensions": {"model": 13, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 8}, "StartTime": 1605106164.299105}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005202374218581531, "sum": 0.005202374218581531, "min": 0.005202374218581531}}, "EndTime": 1605106164.299184, "Dimensions": {"model": 14, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 8}, "StartTime": 1605106164.299166}

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ner", "epoch": 8}, "StartTime": 1605106164.30021}

[11/11/2020 14:49:24 INFO 139746054510400] #quality_metric: host=algo-1, epoc
h=8, train binary_classification_cross_entropy_objective <loss>=0.00516779752
135
[2020-11-11 14:49:25.161] [tensorio] [info] epoch_stats={"data_pipeline": "/o
pt/ml/input/data/validation", "epoch": 26, "duration": 842, "num_examples": 2
9, "num_bytes": 4670884}
#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.012954562941167107, "sum": 0.012954562941167107, "min": 0.012954562941167107}}, "EndTime": 1605106165.669592, "Dimensions": {"model": 18, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 8}, "StartTime": 1605106165.669574}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.01462087783245578, "sum": 0.01462087783245578, "min": 0.01462087783245578}}, "EndTime": 1605106165.669888, "Dimensions": {"model": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 8}, "StartTime": 1605106165.669872}

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[11/11/2020 14:49:25 INFO 139746054510400] #quality_metric: host=algo-1, epoch=8, validation_binary_classification_cross_entropy_objective <loss>=0.0047062301141
[11/11/2020 14:49:25 INFO 139746054510400] #early_stopping_criteria_metric: host=algo-1, epoch=8, criteria=sampled_accuracy, value=0.999473333099
[11/11/2020 14:49:25 INFO 139746054510400] Epoch 8: Loss improved. Updating best model
[11/11/2020 14:49:25 INFO 139746054510400] Saving model for epoch: 8
[11/11/2020 14:49:25 INFO 139746054510400] Saved checkpoint to "/tmp/tmpZnnWZ9/mx-mod-0000.params"
[11/11/2020 14:49:25 INFO 139746054510400] #progress_metric: host=algo-1, completed 60 % of epochs
#metrics {"Metrics": {"Max_Batches_Seen_Between_Resets": {"count": 1, "max": 1}}

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[11/11/2020 14:49:25 INFO 139746054510400] #throughput_metric: host=algo-1, train throughput=26310.1371961 records/second
[2020-11-11 14:49:33.058] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 21, "duration": 7378, "num_examples": 228, "num_bytes": 37366580}
#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005046819795070765, "sum": 0.005046819795070765, "min": 0.005046819795070765}, "EndTime": 1605106173.058669, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106173.058549}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.004326691483348476, "sum": 0.004326691483348476, "min": 0.004326691483348476}, "EndTime": 1605106173.058913, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106173.058893}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005915835795423533, "sum": 0.005915835795423533, "min": 0.005915835795423533}, "EndTime": 1605106173.059049, "Dimensions": {"model": 5, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106173.05903}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.006031700256604718, "sum": 0.006031700256604718, "min": 0.006031700256604718}}, "EndTime": 1605106173.059188, "Dimensions": {"model": 7, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106173.059169}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005135154322643112, "sum": 0.005135154322643112, "min": 0.005135154322643112}}, "EndTime": 1605106173.059453, "Dimensions": {"model": 11, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106173.059436}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005161747298839334, "sum": 0.005161747298839334, "min": 0.005161747298839334}}, "EndTime": 1605106173.05952, "Dimensions": {"model": 12, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106173.059503}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.0056453596981086394, "sum": 0.0056453596981086394, "min": 0.0056453596981086394}}, "EndTime": 1605106173.059588, "Dimensions": {"model": 13, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106173.059569}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005161593463977528, "sum": 0.005161593463977528, "min": 0.005161593463977528}}, "EndTime": 1605106173.059652, "Dimensions": {"model": 14, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106173.059635}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005607949539690816, "sum": 0.005607949539690816, "min": 0.005607949539690816}}, "EndTime": 1605106173.059725, "Dimensions": {"model": 15, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106173.059707}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.011758023568186992, "sum": 0.011758023568186992, "min": 0.011758023568186992}}, "EndTime": 1605106173.059859, "Dimensions": {"model": 17, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106173.059842}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.011783210230293778, "sum": 0.011783210230293778, "min": 0.011783210230293778}}, "EndTime": 1605106173.060194, "Dimensions": {"model": 22, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106173.060176}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective":
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[11/11/2020 14:49:33 INFO 139746054510400] #quality_metric: host=algo-1, epoc
h=9, train binary_classification_cross_entropy_objective <loss>=0.00504681979
507
[2020-11-11 14:49:33.833] [tensorio] [info] epoch_stats={"data_pipeline": "/o
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.0037959622539858995, "sum": 0.0037959622539858995, "min": 0.0037959622539858995}}, "EndTime": 1605106174.310265, "Dimensions": {"model": 6, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106174.31025}

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[11/11/2020 14:49:34 INFO 139746054510400] #quality_metric: host=algo-1, epoch=9, validation_binary_classification_cross_entropy_objective <loss>=0.00459606097675
[11/11/2020 14:49:34 INFO 139746054510400] #early_stopping_criteria_metric: host=algo-1, epoch=9, criteria=sampled_accuracy, value=0.999473333099
[11/11/2020 14:49:34 INFO 139746054510400] Epoch 9: Loss improved. Updating best model
[11/11/2020 14:49:34 INFO 139746054510400] Saving model for epoch: 9
[11/11/2020 14:49:34 INFO 139746054510400] Saved checkpoint to "/tmp/tmpnC2kifF/mx-mod-0000.params"
[11/11/2020 14:49:34 INFO 139746054510400] #progress_metric: host=algo-1, completed 66 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Batches Since Last Reset": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Records Since Last Reset": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Total Batches Seen": {"count": 1, "max": 2292, "sum": 2292.0, "min": 2292}, "Total Records Seen": {"count": 1, "max": 2290450, "sum": 2290450.0, "min": 2290450}, "Max Records Seen Between Resets": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Reset Count": {"count": 1, "max": 12, "sum": 12.0, "min": 12}}, "EndTime": 1605106174.318961, "Dimensions": {"Host": "algo-1", "Metric": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106165.679375}

[11/11/2020 14:49:34 INFO 139746054510400] #throughput_metric: host=algo-1, train throughput=26371.8678704 records/second
[2020-11-11 14:49:41.186] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 23, "duration": 6865, "num_examples": 228, "num_bytes": 37366580}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.004204353242981277, "sum": 0.004204353242981277, "min": 0.004204353242981277}}, "EndTime": 1605106181.187105, "Dimensions": {"model": 6, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605106181.187092}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.012733046361528303, "sum": 0.012733046361528303, "min": 0.012733046361528303}}, "EndTime": 1605106181.188061, "Dimensions": {"model": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605106181.188048}

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[11/11/2020 14:49:41 INFO 139746054510400] #quality_metric: host=algo-1, epoch=10, train binary_classification_cross_entropy_objective <loss>=0.00495453555206
[2020-11-11 14:49:41.995] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 32, "duration": 785, "num_examples": 29, "num_bytes": 4670884}
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[11/11/2020 14:49:42 INFO 139746054510400] #quality_metric: host=algo-1, epoc
h=10, validation binary_classification_cross_entropy_objective <loss>=0.00451
126886483
[11/11/2020 14:49:42 INFO 139746054510400] #early_stopping_criteria_metric: h
ost=algo-1, epoch=10, criteria=sampled_accuracy, value=0.999473333099
[11/11/2020 14:49:42 INFO 139746054510400] Epoch 10: Loss improved. Updating
best model
[11/11/2020 14:49:42 INFO 139746054510400] Saving model for epoch: 10
[11/11/2020 14:49:42 INFO 139746054510400] Saved checkpoint to "/tmp/tmpfEm0S
8/mx-mod-0000.params"
[11/11/2020 14:49:42 INFO 139746054510400] #progress_metric: host=algo-1, com
pleted 73 % of epochs
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[11/11/2020 14:49:42 INFO 139746054510400] #throughput_metric: host=algo-1, train throughput=27825.9199024 records/second
[2020-11-11 14:49:50.006] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 25, "duration": 7495, "num_examples": 228, "num_bytes": 37366580}
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[11/11/2020 14:49:50 INFO 139746054510400] #quality_metric: host=algo-1, epoc
h=11, train binary_classification_cross_entropy_objective <loss>=0.0048826219
4526
[2020-11-11 14:49:50.883] [tensorio] [info] epoch_stats={"data_pipeline": "/o
pt/ml/input/data/validation", "epoch": 35, "duration": 854, "num_examples": 2
9, "num_bytes": 4670884}
#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.014548095883807793, "sum": 0.014548095883807793, "min": 0.014548095883807793}}, "EndTime": 1605106191.370543, "Dimensions": {"model": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106191.370526}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.014023805936188733, "sum": 0.014023805936188733, "min": 0.014023805936188733}}, "EndTime": 1605106191.370615, "Dimensions": {"model": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106191.370598}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.014024900781493446, "sum": 0.014024900781493446, "min": 0.014024900781493446}}, "EndTime": 1605106191.37074, "Dimensions": {"model": 26, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106191.370724}

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[11/11/2020 14:49:51 INFO 139746054510400] #quality_metric: host=algo-1, epoch=11, validation_binary_classification_cross_entropy_objective <loss>=0.00444457085923
[11/11/2020 14:49:51 INFO 139746054510400] #early_stopping_criteria_metric: host=algo-1, epoch=11, criteria=sampled_accuracy, value=0.999473333099
[11/11/2020 14:49:51 INFO 139746054510400] Epoch 11: Loss improved. Updating best model
[11/11/2020 14:49:51 INFO 139746054510400] Saving model for epoch: 11
[11/11/2020 14:49:51 INFO 139746054510400] Saved checkpoint to "/tmp/tmppR4y5U/mx-mod-0000.params"
[11/11/2020 14:49:51 INFO 139746054510400] #progress_metric: host=algo-1, completed 80 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Batches Since Last Reset": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Records Since Last Reset": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Total Batches Seen": {"count": 1, "max": 2748, "sum": 2748.0, "min": 2748}, "Total Records Seen": {"count": 1, "max": 2746140, "sum": 2746140.0, "min": 2746140}, "Max Records Seen Between Resets": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Reset Count": {"count": 1, "max": 14, "sum": 14.0, "min": 14}}, "EndTime": 1605106191.377839, "Dimensions": {"Host": "algo-1", "Metric": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106182.510595}

[11/11/2020 14:49:51 INFO 139746054510400] #throughput_metric: host=algo-1, train throughput=25694.7514366 records/second
[2020-11-11 14:49:58.467] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 27, "duration": 7088, "num_examples": 228, "num_bytes": 37366580}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.0050781639958793375, "sum": 0.0050781639958793375, "min": 0.0050781639958793375}}, "EndTime": 1605106198.468817, "Dimensions": {"model": 11, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 12}, "StartTime": 1605106198.4688}
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[11/11/2020 14:49:58 INFO 139746054510400] #quality_metric: host=algo-1, epoch=12, train binary_classification_cross_entropy_objective <lloss>=0.00482554696205
[2020-11-11 14:49:59.229] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 38, "duration": 740, "num_examples": 29, "num_bytes": 4670884}
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[11/11/2020 14:49:59 INFO 139746054510400] #quality_metric: host=algo-1, epoch=12, validation_binary_classification_cross_entropy_objective <loss>=0.00439149808701
[11/11/2020 14:49:59 INFO 139746054510400] #early_stopping_criteria_metric: host=algo-1, epoch=12, criteria=sampled_accuracy, value=0.999473333099
[11/11/2020 14:49:59 INFO 139746054510400] Epoch 12: Loss improved. Updating best model
[11/11/2020 14:49:59 INFO 139746054510400] Saving model for epoch: 12
[11/11/2020 14:49:59 INFO 139746054510400] Saved checkpoint to "/tmp/tmpPe1mo5/mx-mod-0000.params"
[11/11/2020 14:49:59 INFO 139746054510400] #progress_metric: host=algo-1, completed 86 % of epochs
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[11/11/2020 14:49:59 INFO 139746054510400] #throughput_metric: host=algo-1, train throughput=27312.6447478 records/second
[2020-11-11 14:50:07.444] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 29, "duration": 7720, "num_examples": 228, "num_bytes": 37366580}
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[2020-11-11 14:50:08.272] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 41, "duration": 808, "num_examples": 29, "num_bytes": 4670884}
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[11/11/2020 14:50:08 INFO 139746054510400] #quality_metric: host=algo-1, epoch=13, validation_binary_classification_cross_entropy_objective <loss>=0.00434834163287
[11/11/2020 14:50:08 INFO 139746054510400] #early_stopping_criteria_metric: host=algo-1, epoch=13, criteria=sampled_accuracy, value=0.999473333099
[11/11/2020 14:50:08 INFO 139746054510400] Epoch 13: Loss improved. Updating best model
[11/11/2020 14:50:08 INFO 139746054510400] Saving model for epoch: 13
[11/11/2020 14:50:08 INFO 139746054510400] Saved checkpoint to "/tmp/tmpz5Jh_K/mx-mod-0000.params"
[11/11/2020 14:50:08 INFO 139746054510400] #progress_metric: host=algo-1, completed 93 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Batches Since Last Reset": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Records Since Last Reset": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Total Batches Seen": {"count": 1, "max": 3204, "sum": 3204.0, "min": 3204}, "Total Records Seen": {"count": 1, "max": 3201830, "sum": 3201830.0, "min": 3201830}, "Max Records Seen Between Resets": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Reset Count": {"count": 1, "max": 16, "sum": 16.0, "min": 16}}, "EndTime": 1605106208.76893, "Dimensions": {"Host": "algo-1", "Metric": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605106199.723395}

[11/11/2020 14:50:08 INFO 139746054510400] #throughput_metric: host=algo-1, train throughput=25188.3694396 records/second
[2020-11-11 14:50:15.728] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 31, "duration": 6958, "num_examples": 228, "num_bytes": 37366580}
#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.00474226943616825, "sum": 0.00474226943616825, "min": 0.00474226943616825}}, "EndTime": 1605106215.729008, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605106215.728885}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005975774023140317, "sum": 0.005975774023140317, "min": 0.005975774023140317}}, "EndTime": 1605106215.729489, "Dimensions": {"model": 7, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605106215.729471}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005442633599961907, "sum": 0.005442633599961907, "min": 0.005442633599961907}}, "EndTime": 1605106215.729556, "Dimensions": {"model": 8, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605106215.729538}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.005064709416307542, "sum": 0.005064709416307542, "min": 0.005064709416307542}}, "EndTime": 1605106215.729745, "Dimensions": {"model": 11, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605106215.729728}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.00506362127758858, "sum": 0.00506362127758858, "min": 0.00506362127758858}}, "EndTime": 1605106215.729945, "Dimensions": {"model": 14, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605106215.729927}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.011827090102670476, "sum": 0.011827090102670476, "min": 0.011827090102670476}}, "EndTime": 1605106215.730081, "Dimensions": {"model": 16, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605106215.730054}

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[11/11/2020 14:50:15 INFO 139746054510400] #quality_metric: host=algo-1, epoch=14, train binary_classification_cross_entropy_objective <loss>=0.00474226943617
[2020-11-11 14:50:16.626] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 44, "duration": 874, "num_examples": 29, "num_bytes": 4670884}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.003714052400521685, "sum": 0.003714052400521685, "min": 0.003714052400521685}}, "EndTime": 1605106217.11787, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605106217.117855}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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```
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```

```

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[11/11/2020 14:50:17 INFO 139746054510400] #early_stopping_criteria_metric: host=algo-1, epoch=14, criteria=sampled_accuracy, value=0.999473333099
[11/11/2020 14:50:17 INFO 139746054510400] Epoch 14: Loss improved. Updating best model
[11/11/2020 14:50:17 INFO 139746054510400] Saving model for epoch: 14
[11/11/2020 14:50:17 INFO 139746054510400] Saved checkpoint to "/tmp/tmpxi2WU0/mx-mod-0000.params"
[11/11/2020 14:50:17 INFO 139746054510400] #progress_metric: host=algo-1, completed 100 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Batches Since Last Reset": {"count": 1, "max": 228, "sum": 228.0, "min": 228}, "Number of Records Since Last Reset": {"count": 1, "max": 227845, "sum": 227845.0, "min": 227845}, "Total Batches Seen": {"count": 1, "max": 3432, "sum": 3432.0, "min": 3432}, "Total Records Seen": {"count": 1, "max": 3429675, "sum": 3429675.0, "min": 3429675}, "Max Records Seen Between Resets": {"count": 1, "max": 227845, "sum": 227845}}

```

```
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rain throughput=27265.6765998 records/second  
[11/11/2020 14:50:17 WARNING 139746054510400] wait_for_all_workers will not s  
ync workers since the kv store is not running distributed  
[11/11/2020 14:50:17 WARNING 139746054510400] wait_for_all_workers will not s  
ync workers since the kv store is not running distributed  
[2020-11-11 14:50:17.819] [tensorio] [info] epoch_stats={"data_pipeline": "/o  
pt/ml/input/data/validation", "epoch": 47, "duration": 675, "num_examples": 2  
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[11/11/2020 14:50:18 INFO 139746054510400] #early_stopping_criteria_metric: h  
ost=algo-1, epoch=14, criteria=sampled_accuracy, value=0.999473333099  
[11/11/2020 14:50:18 INFO 139746054510400] Epoch 14: Loss improved. Updating  
best model  
[2020-11-11 14:50:18.450] [tensorio] [info] epoch_stats={"data_pipeline": "/o  
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9, "num_bytes": 4670884}  
[11/11/2020 14:50:18 INFO 139746054510400] #validation_score (algo-1) : ('bin  
ary_classification_cross_entropy_objective', 0.00431326223488734)  
[11/11/2020 14:50:18 INFO 139746054510400] #validation_score (algo-1) : ('bin  
ary_classification_accuracy', 0.9994382219725431)  
[11/11/2020 14:50:18 INFO 139746054510400] #validation_score (algo-1) : ('bin  
ary_f_1.000', 0.8571428571428571)  
[11/11/2020 14:50:18 INFO 139746054510400] #validation_score (algo-1) : ('pre  
cision', 0.8421052631578947)  
[11/11/2020 14:50:18 INFO 139746054510400] #validation_score (algo-1) : ('rec  
all', 0.8727272727272727)  
[11/11/2020 14:50:18 INFO 139746054510400] #validation_score (algo-1) : ('roc  
_auc_score', 0.9912570438075258)  
[11/11/2020 14:50:18 INFO 139746054510400] #quality_metric: host=algo-1, vali  
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[11/11/2020 14:50:18 INFO 139746054510400] #quality_metric: host=algo-1, vali  
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[11/11/2020 14:50:18 INFO 139746054510400] #quality_metric: host=algo-1, vali  
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[11/11/2020 14:50:18 INFO 139746054510400] #quality_metric: host=algo-1, vali  
dation precision <score>=0.842105263158  
[11/11/2020 14:50:18 INFO 139746054510400] #quality_metric: host=algo-1, vali  
dation recall <score>=0.872727272727  
[11/11/2020 14:50:18 INFO 139746054510400] #quality_metric: host=algo-1, vali  
dation roc_auc_score <score>=0.991257043808  
[11/11/2020 14:50:18 INFO 139746054510400] Best model found for hyperparamete  
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[11/11/2020 14:50:18 INFO 139746054510400] Saved checkpoint to "/tmp/tmpfiPiz  
/_mx-mod-0000.params"  
[2020-11-11 14:50:18.465] [tensorio] [info] epoch_stats={"data_pipeline": "/o  
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[2020-11-11 14:50:18.570] [tensorio] [info] epoch_stats={"data_pipeline": "/o  
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```

```

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[11/11/2020 14:50:18 INFO 139746054510400] #test_score (algo-1) : ('binary_classification_cross_entropy_objective', 0.005026486952449409)
[11/11/2020 14:50:18 INFO 139746054510400] #test_score (algo-1) : ('binary_classification_accuracy', 0.9993328885923949)
[11/11/2020 14:50:18 INFO 139746054510400] #test_score (algo-1) : ('binary_f_1.000', 0.7956989247311828)
[11/11/2020 14:50:18 INFO 139746054510400] #test_score (algo-1) : ('precision', 0.7872340425531915)
[11/11/2020 14:50:18 INFO 139746054510400] #test_score (algo-1) : ('recall', 0.8043478260869565)
[11/11/2020 14:50:18 INFO 139746054510400] #test_score (algo-1) : ('roc_auc_score', 0.9713970076681371)
[11/11/2020 14:50:18 INFO 139746054510400] #quality_metric: host=algo-1, test binary_classification_cross_entropy <loss>=0.00502648695245
[11/11/2020 14:50:18 INFO 139746054510400] #quality_metric: host=algo-1, test binary_classification_accuracy <score>=0.999332888592
[11/11/2020 14:50:18 INFO 139746054510400] #quality_metric: host=algo-1, test binary_f_1.000 <score>=0.795698924731
[11/11/2020 14:50:18 INFO 139746054510400] #quality_metric: host=algo-1, test precision <score>=0.787234042553
[11/11/2020 14:50:18 INFO 139746054510400] #quality_metric: host=algo-1, test recall <score>=0.804347826087
[11/11/2020 14:50:18 INFO 139746054510400] #quality_metric: host=algo-1, test roc_auc_score <score>=0.971397007668
#metrics {"Metrics": {"totaltime": {"count": 1, "max": 130925.66895484924, "sum": 130925.66895484924, "min": 130925.66895484924}, "finalize.time": {"count": 1, "max": 1335.4439735412598, "sum": 1335.4439735412598, "min": 1335.4439735412598}, "initialize.time": {"count": 1, "max": 251.28889083862305, "sum": 251.28889083862305, "min": 251.28889083862305}, "check_early_stopping.time": {"count": 16, "max": 1.280069351196289, "sum": 17.152786254882812, "min": 0.9770393371582031}, "setuptime": {"count": 1, "max": 26.182889938354492, "sum": 26.182889938354492, "min": 26.182889938354492}, "update.time": {"count": 15, "max": 9043.01905632019, "sum": 128907.25135803223, "min": 8039.921045303345}, "epochs": {"count": 1, "max": 15, "sum": 15.0, "min": 15}}, "EndTime": 1605106218.584668, "Dimensions": {"Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner"}, "StartTime": 1605106087.879534}

```

2020-11-11 14:50:28 Uploading - Uploading generated training model

2020-11-11 14:50:28 Completed - Training job completed

Training seconds: 221

Billable seconds: 221

Model evaluation

In this section, you'll evaluate your trained model. First, use the `estimator.deploy` function with `initial_instance_count= 1` and `instance_type= 'ml.m4.xlarge'` to deploy your model on Amazon SageMaker.

```
In [27]: linear_predictor = linear.deploy(initial_instance_count=1, instance_type='ml.m4.xlarge')
```

```
Defaulting to the only supported framework/algorithm version: 1. Ignoring framework/algorithm version: 1.
```

```
-----!
```

Now that you have a hosted endpoint running, you can make real-time predictions from the model easily by making an http POST request. But first, you'll need to set up serializers and deserializers for passing your `test_features` NumPy arrays to the model behind the endpoint. You will also calculate the confusion matrix for your model to evaluate how it has done on your test data visually.

```
In [28]: from sklearn.metrics import accuracy_score,precision_score, recall_score
#from sagemaker.predictor import csv_serializer, json_deserializer,numpy_deserializer
#from sagemaker.predictor import csv_deserializer

def predict_batches(model, features, labels, split=200):
    """
    Predict datapoints in batches specified by the split.
    The data will be split into <split> parts and model.predict is called
    on each part
    Arguments:
        model: The model that you will use to call predict function
        features: The dataset to predict on
        Labels: The true value of the records
        split: Number of parts to split the data into
    Returns:
        None
    """

    split_array = np.array_split(features, split)
    predictions = []
    for array in split_array:
        predictions += model.predict(array)

    # preds = np.array([p['predicted_label'] for p in predictions])
    preds = [i.label['predicted_label'].float32_tensor.values[0] for i in predictions]

    # Calculate accuracy
    accuracy = accuracy_score(labels, preds)
    print(f'Accuracy: {accuracy}')

    # Calculate precision
    precision = precision_score(labels, preds)
    print(f'Precision: {precision}')

    # Calculate recall
    recall = recall_score(labels, preds)
    print(f'Recall: {recall}')

    confusion_matrix = pd.crosstab(index=labels, columns=np.round(preds), rownames=['True'], colnames=['predictions']).astype(int)
    plt.figure(figsize = (5,5))
    sns.heatmap(confusion_matrix, annot=True, fmt='.2f', cmap="YlGnBu").set_title('Confusion Matrix')
```

Now that your endpoint is 'InService', evaluate how your model performs on the test set. Compare that test set performance to the performance on the training set.

Key questions to consider:

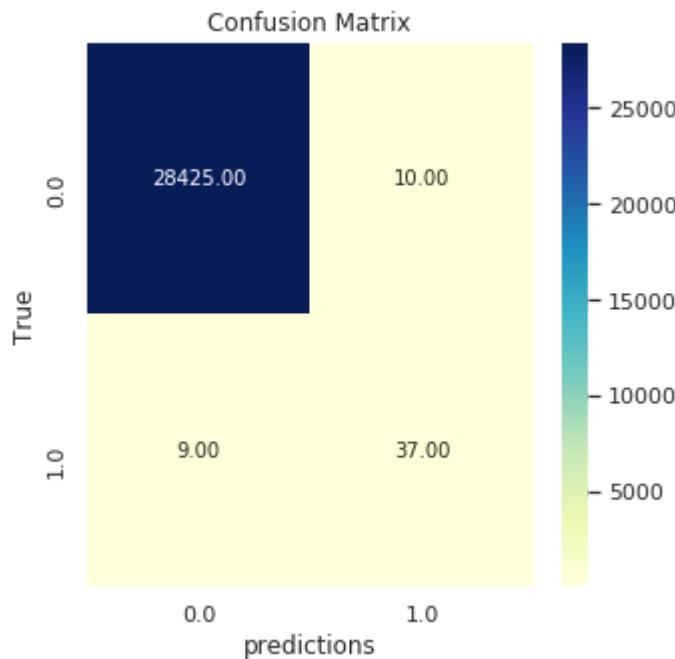
1. How does your model's performance on the test set compare to the training set? What can you deduce from this comparison?
2. Are there obvious differences between the outcomes of metrics like accuracy, precision, and recall? If so, why might you be seeing those differences?
3. Given your business situation and goals, which metric(s) is most important for you to consider here? Why?
4. Is the outcome for the metric(s) you consider most important sufficient for what you need from a business standpoint? If not, what are some things you might change in your next iteration (in the feature engineering section, which is coming up next)?

Use the cells below to answer these and other questions. Insert and delete cells where needed.

Project presentation: Record answers to these and other similar questions you might answer in this section in your project presentations. Record key details and decisions you've made in your project presentations.

```
In [29]: predict_batches(linear_predictor, test_features, test_labels)
```

```
Accuracy: 0.9993328885923949
Precision: 0.7872340425531915
Recall: 0.8043478260869565
```



Similar to the test set, you can also look at the metrics for the training set. Keep in mind that those are also shown to you above in the logs.

```
In [30]: #predict_batches(Linear_predictor, train_features, train_labels)
```

```
In [31]: # Delete inference endpoint
sagemaker.Session().delete_endpoint(linear_predictor.endpoint_name)
```

Project Solution Lab 4:

Iteration II

Step 4: Feature engineering

You've now gone through one iteration of training and evaluating your model. Given that the outcome you reached for your model the first time probably wasn't sufficient for solving your business problem, what are some things you could change about your data to possibly improve model performance?

Key questions to consider:

1. How might the balance of your two main classes (fraud and not fraud) impact model performance?
2. Does balancing your dataset have any impact on correlations between your features?
3. Are there feature reduction techniques you could perform at this stage that might have a positive impact on model performance?
4. After performing some feature engineering, how does your model performance compare to the first iteration?

Use the cells below to perform specific feature engineering techniques (per the questions above) that you think could improve your model performance. Insert and delete cells where needed.

Project presentation: Record key decisions and methods you use in this section in your project presentations, as well as any new performance metrics you obtain after evaluating your model again.

Before you start, think about why the precision and recall are around 80% while the accuracy is 99%.

Answer: Imbalanced datasets!

The accuracy is calculated with how many examples the model got right. However, most of the examples are actually negative, so if you actually predict all examples as zero in this very imbalanced dataset, you can still get an accuracy of about 99.827%. Having an imbalanced dataset may cause some problems with algorithm performance. So it's useful to treat the imbalance in the data before you train the model.

Question: How do you solve the problem of dataset imbalance?

Answer: You resample the dataset to create at least a balanced class distribution.

Question: Print the shape of your datasets again.

```
In [32]: print(f"Length of train_features is: {train_features.shape}")  
print(f"Length of train_labels is: {train_labels.shape}")  
print(f"Length of val_features is: {val_features.shape}")  
print(f"Length of val_labels is: {val_labels.shape}")  
print(f"Length of test_features is: {test_features.shape}")  
print(f"Length of test_labels is: {test_labels.shape}")
```

```
Length of train_features is: (227845, 29)  
Length of train_labels is: (227845,)  
Length of val_features is: (28481, 29)  
Length of val_labels is: (28481,)  
Length of test_features is: (28481, 29)  
Length of test_labels is: (28481,)
```

Use `sns.countplot` to plot the original distribution of the dataset.

```
In [33]: sns.countplot(df['Class'])
plt.title('Original Distribution of the dataset')
```

```
Out[33]: Text(0.5, 1.0, 'Original Distribution of the dataset')
```



Convert `train_features` back into a DataFrame.

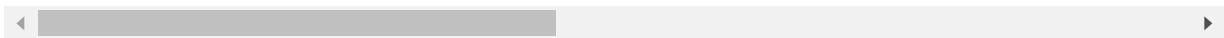
```
In [34]: df_train = pd.DataFrame(train_features, columns = df.columns.drop(['Time', 'Class']))
df_train['Target'] = train_labels
```

```
In [35]: df_train.head()
```

```
Out[35]:
```

	V1	V2	V3	V4	V5	V6	V7	V8	V
0	-1.115047	1.035583	0.800712	-1.060398	0.032621	0.853422	-0.614244	-3.231161	1.53994
1	1.228473	-0.138826	0.473795	-0.166381	-0.453564	-0.190135	-0.355309	0.048598	0.12894
2	1.926148	-0.198628	-0.286727	1.596852	-0.488963	-0.311405	-0.303207	0.035513	1.30131
3	2.046232	0.196183	-1.704650	0.530027	0.177496	-1.443091	0.255403	-0.365759	0.60294
4	-0.837077	1.034710	2.333129	3.103776	0.229143	0.501123	0.314283	-0.161583	0.40963

5 rows × 30 columns



There are two main ways to handle imbalanced datasets:

- Oversample to add more positive samples
 - Random oversampling
 - [Synthetic minority oversampling technique \(SMOTE\)](https://arxiv.org/abs/1106.1813) (<https://arxiv.org/abs/1106.1813>)
- Undersample to reduce the negative samples
 - Random undersampling
 - Generate centroids using clustering methods

You can use a library called `Imbalanced-learn` for sampling the datasets. `imbalanced-learn` is a Python package offering a number of resampling techniques commonly used in datasets showing strong between-class imbalance. It is compatible with `scikit-learn` and is part of `scikit-learn-contrib` projects. For more information, see [imbalanced-learn API documentation](https://imbalanced-learn.org/stable/introduction.html) (<https://imbalanced-learn.org/stable/introduction.html>).

Choose undersampling for this example first. To create the balanced dataset:

1. Create a new DataFrame `fraud_df` with all the positive examples.
2. Create another DataFrame `non_fraud_df` and use `dataframe.sample` with the same number as the `fraud_df` DataFrame and `random_state=235`.
3. Concatenate both DataFrames into a new DataFrame `balanced_df`.

```
In [36]: fraud_df = df_train[df_train['Target'] == 1]

non_fraud_df = df_train[df_train['Target'] == 0].sample(n=len(fraud_df), random_state=235)

balanced_df = pd.concat([fraud_df, non_fraud_df], ignore_index=True, sort=False)

balanced_df.head()
```

Out[36]:

	V1	V2	V3	V4	V5	V6	V7	V8	V9
0	-2.866364	2.346949	-4.053307	3.983359	-3.463186	-1.280953	-4.474764	1.216655	-2.30982
1	1.227614	-0.668974	-0.271785	-0.589440	-0.604795	-0.350285	-0.486365	-0.010809	-0.79494
2	0.447396	2.481954	-5.660814	4.455923	-2.443780	-2.185040	-4.716143	1.249803	-0.71832
3	1.243848	0.524526	-0.538884	1.209196	0.479538	-0.197429	0.049166	0.037792	0.12817
4	-2.003459	-7.159042	-4.050976	1.309580	-2.058102	-0.098621	2.880083	-0.727484	1.46038

5 rows × 30 columns

Check the distribution and shape again using `sns.countplot()`.

```
In [37]: sns.countplot(balanced_df['Target'])
plt.title('Original Distribution of the dataset')
```

```
Out[37]: Text(0.5, 1.0, 'Original Distribution of the dataset')
```



```
In [38]: balanced_df.shape
```

```
Out[38]: (782, 30)
```

Before looking at the training, look at what will happen if you use a feature reduction technique like t-Distributed Stochastic Neighbor Embedding (t-SNE) on the dataset.

```
In [39]: from sklearn.manifold import TSNE
```

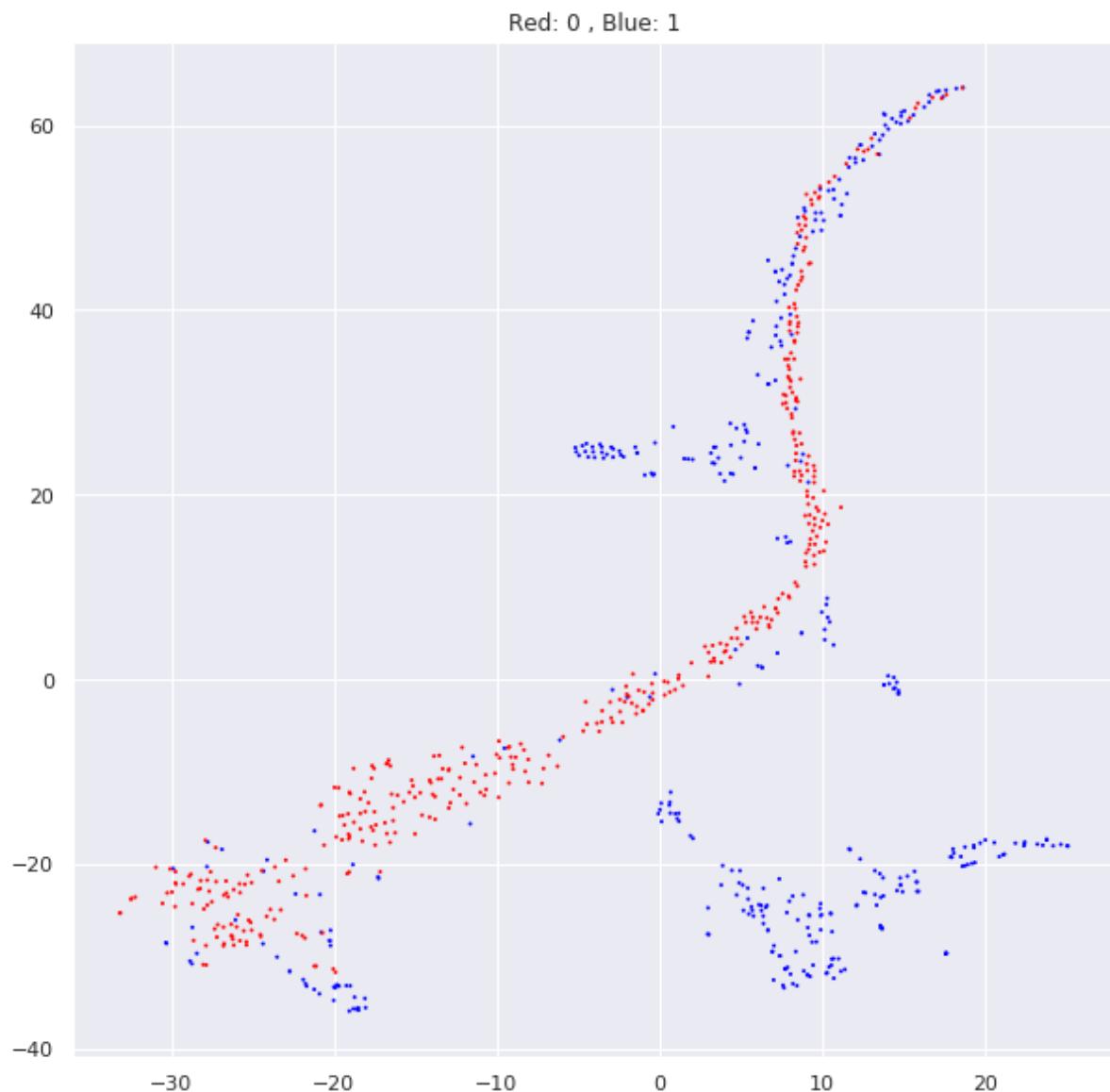
```
X_embedded = TSNE(n_components=2).fit_transform(balanced_df.drop(columns = "Target"))
X_embedded.shape
```

```
Out[39]: (782, 2)
```

```
In [40]: from matplotlib.colors import ListedColormap
plt.figure(figsize = (10,10))
plt.scatter(X_embedded[:,0], X_embedded[:,1],
            c = balanced_df[ 'Target' ],
            s = 1,
            cmap = ListedColormap([ 'Red', 'Blue']),
            linewidths=1)

plt.title('Red: 0 , Blue: 1')
```

Out[40]: Text(0.5, 1.0, 'Red: 0 , Blue: 1')



Question: Does t-SNE help you differentiate the fraud from not fraud?

Answer: t-SNE can differentiate between some of the fraud and not fraud cases, but it doesn't do a good job of completely differentiating the two when we reduce the data to just two dimensions.

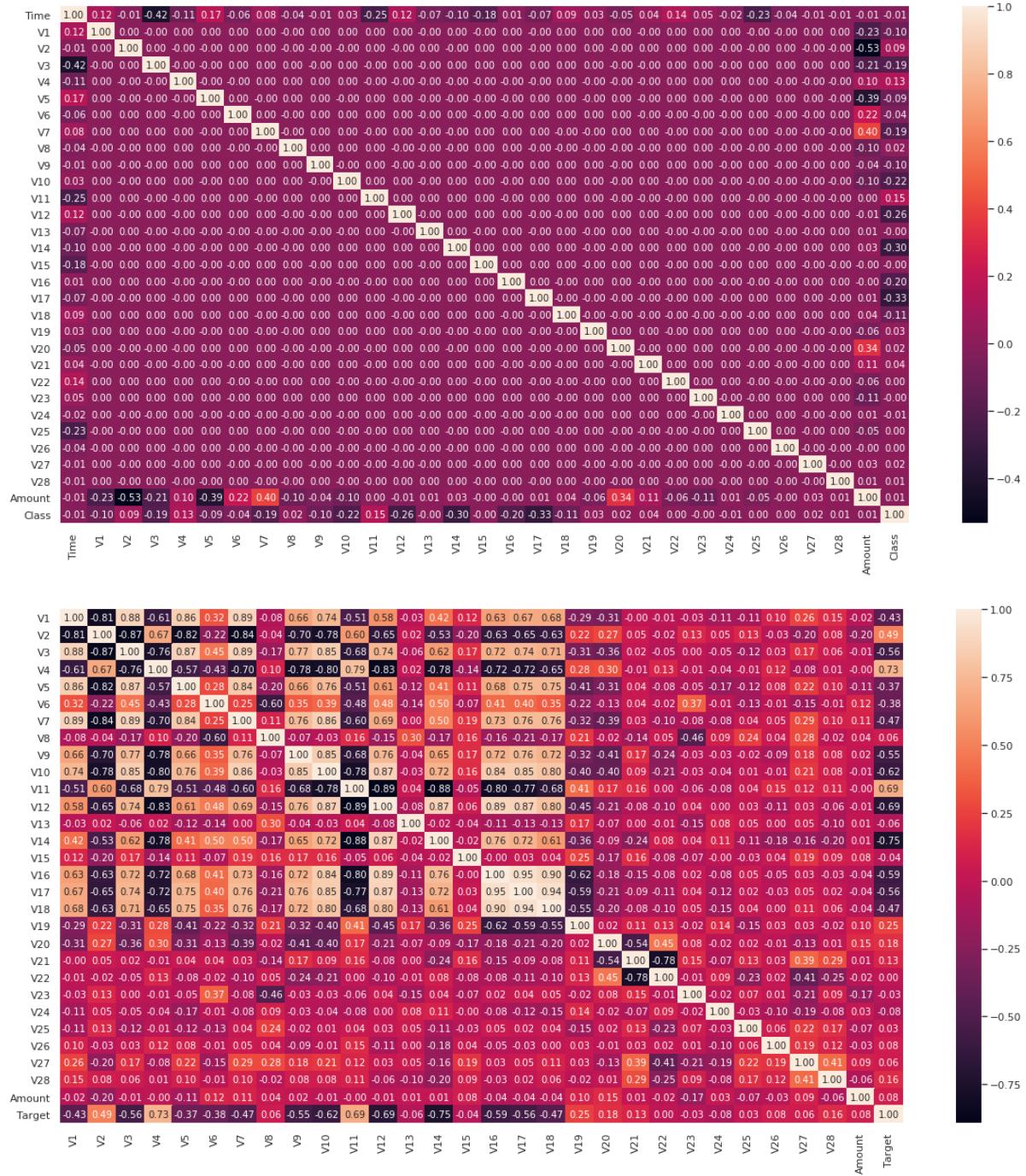
Now that you have the new data, compare what the correlation matrix looks like before and after.

In [41]: # Make sure to use the subsample in the correlation

```
plt.figure(figsize = (20,10))
correlation_matrix_before = df.corr()
sns.heatmap(correlation_matrix_before, annot=True, fmt=".2f")

plt.figure(figsize = (20,10))
correlation_matrix_after = balanced_df.corr()
sns.heatmap(correlation_matrix_after, annot=True, fmt=".2f")
```

Out[41]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd9775e4898>



Question: What can you deduce from looking at the different correlation matrices? If you see a difference, can you analyze why there is a difference?

Answer: In the unbalanced set, the correlation matrix didn't show any **linear** relationships, but in this smaller balanced dataset, you can see some linear relationships.

Question: Would you drop any columns because of the correlated data?

Answer: Yes, remove any features that have more than 90% correlation.

Because there are some correlations, let's remove the correlated data that has more than 0.9 correlation. Run the following cell to drop the V17 and V18 columns.

```
In [42]: balanced_df_drop = balanced_df.drop(columns=['V17', 'V18'])
```

Now it's time to train, deploy, and evaluate using the new balanced dataset.

```
In [43]: # Instantiate the LinearLearner estimator object
num_classes = len(pd.unique(train_labels))
linear_estimator_balanced = sagemaker.LinearLearner(role=sagemaker.get_execution_role(),
                                                       instance_count=1,
                                                       instance_type='ml.m4.xlarge',
                                                       predictor_type='binary_classifier')

train_records_bal = linear_estimator_balanced.record_set(balanced_df.drop(['Target'], axis=1).values,
                                                          balanced_df['Target'].values,
                                                          channel='train')
val_records_bal = linear_estimator_balanced.record_set(val_features, val_labels, channel='validation')
test_records_bal = linear_estimator_balanced.record_set(test_features, test_labels, channel='test')

linear_estimator_balanced.fit([train_records_bal, val_records_bal, test_records_bal])
```

Defaulting to the only supported framework/algorithm version: 1. Ignoring framework/algorithm version: 1.

Defaulting to the only supported framework/algorithm version: 1. Ignoring framework/algorithm version: 1.

```
2020-11-11 14:58:56 Starting - Starting the training job...
2020-11-11 14:59:00 Starting - Launching requested ML instances.....
2020-11-11 15:00:26 Starting - Preparing the instances for trainin
g.....
2020-11-11 15:02:23 Downloading - Downloading input data...
2020-11-11 15:02:55 Training - Training image download completed. Training in
progress..Docker entrypoint called with argument(s): train
Running default environment configuration script
[11/11/2020 15:02:59 INFO 140590801676096] Reading default configuration from
/opt/amazon/lib/python2.7/site-packages/algorithm/resources/default-input.json: {u'loss_inensitivity': u'0.01', u'epochs': u'15', u'feature_dim': u'aut
o', u'init_bias': u'0.0', u'lr_scheduler_factor': u'auto', u'num_calibration_
samples': u'10000000', u'accuracy_top_k': u'3', u'_num_kv_servers': u'auto',
u'use_bias': u'true', u'num_point_for_scaler': u'10000', u'_log_level': u'in
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u'_enable_profiler': u>false', u'normalize_label': u'auto', u'_num_gpus':
u'auto', u'balance_multiclass_weights': u>false', u'positive_example_weight_
mult': u'1.0', u'l1': u'auto', u'margin': u'1.0'}
[11/11/2020 15:02:59 INFO 140590801676096] Merging with provided configuratio
n from /opt/ml/input/config/hyperparameters.json: {u'feature_dim': u'29', u'm
ini_batch_size': u'782', u'predictor_type': u'binary_classifier'}
[11/11/2020 15:02:59 INFO 140590801676096] Final configuration: {u'loss_insen
sitivity': u'0.01', u'epochs': u'15', u'feature_dim': u'29', u'init_bias':
u'0.0', u'lr_scheduler_factor': u'auto', u'num_calibration_samples': u'10000
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u'_num_gpus': u'auto', u'balance_multiclass_weights': u>false', u'positive_e
xample_weight_mult': u'1.0', u'l1': u'auto', u'margin': u'1.0'}
[11/11/2020 15:02:59 WARNING 140590801676096] Loggers have already been setu
p.
Process 1 is a worker.
[11/11/2020 15:02:59 INFO 140590801676096] Using default worker.
[11/11/2020 15:03:00 INFO 140590801676096] Checkpoint loading and saving are
```

```

disabled.

[2020-11-11 15:03:00.042] [tensorio] [warning] TensorIO is already initialized; ignoring the initialization routine.
[2020-11-11 15:03:00.046] [tensorio] [warning] TensorIO is already initialized; ignoring the initialization routine.
[2020-11-11 15:03:00.080] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 0, "duration": 40, "num_examples": 1, "num_bytes": 128248}
[11/11/2020 15:03:00 INFO 140590801676096] Create Store: local
[2020-11-11 15:03:00.112] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 1, "duration": 30, "num_examples": 1, "num_bytes": 128248}
[11/11/2020 15:03:00 INFO 140590801676096] Scaler algorithm parameters
<algorithm.scaler.ScalerAlgorithmStable object at 0x7fdd79d87750>
[11/11/2020 15:03:00 INFO 140590801676096] Scaling model computed with parameters:
{'stdev_weight':
[ 5.8339443   3.9075756   6.3224893   3.1574216   4.450968
  1.7596539   6.0804424   5.3700695   2.3641775   4.567193
  2.6961005   4.499075   1.0471629   4.5561895   0.96556026
  3.4789944   6.0050545   2.4242449   1.2841583   1.148906
  3.0811567   1.2593688   1.2206893   0.5589278   0.6821132
  0.48198918  1.0988803   0.42951596  231.0245    ]
<NDArray 29 @cpu(0)>, 'stdev_label': None, 'mean_label': None, 'mean_weight':
[-2.4022667e+00  1.7937346e+00 -3.6207638e+00  2.1945949e+00
 -1.6720513e+00 -7.2324634e-01 -2.8667891e+00  2.7016309e-01
 -1.2487314e+00 -2.7932987e+00  1.8461170e+00 -3.0483112e+00
 -3.9330218e-02 -3.4131358e+00 -5.2753348e-02 -2.0460858e+00
 -3.3470883e+00 -1.1339269e+00  3.5984859e-01  1.7003600e-01
  4.2367792e-01 -4.1929659e-02  6.7267604e-03 -4.5011587e-02
  3.0538887e-02  1.4433341e-02  1.1301957e-02  3.1756964e-02
  1.0684237e+02]
<NDArray 29 @cpu(0)>}
[11/11/2020 15:03:00 INFO 140590801676096] nvidia-smi took: 0.0251889228821 seconds to identify 0 gpus
[11/11/2020 15:03:00 INFO 140590801676096] Number of GPUs being used: 0
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Batches Since Last Reset": {"count": 1, "max": 0, "sum": 0.0, "min": 0}, "Number of Records Since Last Reset": {"count": 1, "max": 0, "sum": 0.0, "min": 0}, "Total Batches Seen": {"count": 1, "max": 2, "sum": 2.0, "min": 2}, "Total Records Seen": {"count": 1, "max": 1564, "sum": 1564.0, "min": 1564}, "Max Records Seen Between Resets": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Reset Count": {"count": 1, "max": 2, "sum": 2.0, "min": 2}}, "EndTime": 1605106980.219178, "Dimensions": {"Host": "algo-1", "Meta": "init_train_data_iter", "Operation": "training", "Algorithm": "Linear Learner"}, "StartTime": 1605106980.219133}

[2020-11-11 15:03:00.266] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 4, "duration": 47, "num_examples": 1, "num_bytes": 128248}
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```

```
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```

```
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```

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[11/11/2020 15:03:00 INFO 140590801676096] #quality_metric: host=algo-1, epoch=0, train binary_classification_cross_entropy_objective <loss>=0.667332876064
[2020-11-11 15:03:00.299] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 0, "duration": 256, "num_examples": 1, "num_bytes": 128248}
[2020-11-11 15:03:01.444] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 2, "duration": 1144, "num_examples": 37, "num_bytes": 4670884}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6906724924920822, "sum": 0.6906724924920822, "min": 0.6906724924920822}}, "EndTime": 1605106982.303186, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106982.30317}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.7215665680174873, "sum": 0.7215665680174873, "min": 0.7215665680174873}}, "EndTime": 1605106982.303444, "Dimensions": {"mode1": 7, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106982.303424}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.667189802238979, "sum": 0.667189802238979, "min": 0.667189802238979}}, "EndTime": 1605106982.303522, "Dimensions": {"model": 8, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106982.303502}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti  
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti  
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti  
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti  
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti  
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.7307336178477538, "sum": 0.7307336178477538, "min": 0.7307336178477538}}, "EndTime": 1605106982.304647, "Dimensions": {"model": 1": 25, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106982.30463}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6450334710144963, "sum": 0.6450334710144963, "min": 0.6450334710144963}}, "EndTime": 1605106982.30477, "Dimensions": {"model": 1": 27, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106982.304754}

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[11/11/2020 15:03:02 INFO 140590801676096] #quality_metric: host=algo-1, epoch=0, validation_binary_classification_cross_entropy_objective <loss>=0.626489567692
[11/11/2020 15:03:02 INFO 140590801676096] #early_stopping_criteria_metric: host=algo-1, epoch=0, criteria=sampled_accuracy, value=0.999262666339

```

```
[11/11/2020 15:03:02 INFO 140590801676096] Epoch 0: Loss improved. Updating best model
[11/11/2020 15:03:02 INFO 140590801676096] Saving model for epoch: 0
[11/11/2020 15:03:02 INFO 140590801676096] Saved checkpoint to "/tmp/tmpxwmgwv/mx-mod-0000.params"
[11/11/2020 15:03:02 INFO 140590801676096] #progress_metric: host=algo-1, completed 6 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Batches Since Last Reset": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Records Since Last Reset": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Total Batches Seen": {"count": 1, "max": 3, "sum": 3.0, "min": 3}, "Total Records Seen": {"count": 1, "max": 2346, "sum": 2346.0, "min": 2346}, "Max Records Seen Between Resets": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Reset Count": {"count": 1, "max": 3, "sum": 3.0, "min": 3}}, "EndTime": 1605106982.317427, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605106980.219469}

[11/11/2020 15:03:02 INFO 140590801676096] #throughput_metric: host=algo-1, train throughput=372.716404145 records/second
[2020-11-11 15:03:02.380] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 6, "duration": 62, "num_examples": 1, "num_bytes": 128248}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.7184028332800512, "sum": 0.7184028332800512, "min": 0.7184028332800512}}, "EndTime": 1605106982.381049, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106982.381028}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.47796615249360613, "sum": 0.47796615249360613, "min": 0.47796615249360613}}, "EndTime": 1605106982.381673, "Dimensions": {"model": 12, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106982.381655}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.49406889698389544, "sum": 0.49406889698389544, "min": 0.49406889698389544}}, "EndTime": 1605106982.381739, "Dimensions": {"model": 13, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106982.38172}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.44725914684402973, "sum": 0.44725914684402973, "min": 0.44725914684402973}}, "EndTime": 1605106982.381803, "Dimensions": {"model": 14, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106982.381784}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.7430655633092231, "sum": 0.7430655633092231, "min": 0.7430655633092231}}, "EndTime": 1605106982.382016, "Dimensions": {"model": 17, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106982.381998}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.7523428290091512, "sum": 0.7523428290091512, "min": 0.7523428290091512}}, "EndTime": 1605106982.38217, "Dimensions": {"model": 19, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106982.38215}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5707640586911565, "sum": 0.5707640586911565, "min": 0.5707640586911565}}, "EndTime": 1605106982.382248, "Dimensions": {"model": 20, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106982.382229}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.7827523077845269, "sum": 0.7827523077845269, "min": 0.7827523077845269}}, "EndTime": 1605106982.38287, "Dimensions": {"model": 28, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106982.38285}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.9243856366638028, "sum": 0.9243856366638028, "min": 0.9243856366638028}}, "EndTime": 1605106982.383014, "Dimensions": {"model": 30, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106982.382995}

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[11/11/2020 15:03:02 INFO 140590801676096] #quality_metric: host=algo-1, epoch=1, train_binary_classification_cross_entropy_objective <loss>=0.645284901495
[2020-11-11 15:03:03.542] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 5, "duration": 1128, "num_examples": 37, "num_bytes": 4670884}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.21454592421794766, "sum": 0.21454592421794766, "min": 0.21454592421794766}}, "EndTime": 1605106984.043058, "Dimensions": {"model": 7, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106984.043041}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.2266744839534436, "sum": 0.2266744839534436, "min": 0.2266744839534436}}, "EndTime": 1605106984.043434, "Dimensions": {"mode1": 13, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106984.043416}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti  
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti  
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti  
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti  
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[11/11/2020 15:03:04 INFO 140590801676096] #quality_metric: host=algo-1, epoch=1, validation binary_classification_cross_entropy_objective <loss>=0.622093866357
[11/11/2020 15:03:04 INFO 140590801676096] #early_stopping_criteria_metric: host=algo-1, epoch=1, criteria=sampled_accuracy, value=0.999367999719
[11/11/2020 15:03:04 INFO 140590801676096] Epoch 1: Loss improved. Updating best model
[11/11/2020 15:03:04 INFO 140590801676096] Saving model for epoch: 1
[11/11/2020 15:03:04 INFO 140590801676096] Saved checkpoint to "/tmp/tmpkL0JzQ/mx-mod-0000.params"
[11/11/2020 15:03:04 INFO 140590801676096] #progress_metric: host=algo-1, completed 13 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Batches Since Last Reset": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Records Since Last Reset": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Total Batches Seen": {"count": 1, "max": 4, "sum": 4.0, "min": 4}, "Total Records Seen": {"count": 1, "max": 3128, "sum": 3128.0, "min": 3128}, "Max Records Seen Between Resets": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Reset Count": {"count": 1, "max": 4, "sum": 4.0, "min": 4}}, "EndTime": 1605106984.051025, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605106982.317776}

[11/11/2020 15:03:04 INFO 140590801676096] #throughput_metric: host=algo-1, train throughput=451.137521921 records/second
[2020-11-11 15:03:04.093] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 8, "duration": 41, "num_examples": 1, "num_bytes": 128248}
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[2020-11-11 15:03:05.167] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 8, "duration": 1042, "num_examples": 37, "num_bytes": 4670884}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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[11/11/2020 15:03:05 INFO 140590801676096] #quality_metric: host=algo-1, epoc
h=2, validation_binary_classification_cross_entropy_objective <loss>=0.617400
72016
[11/11/2020 15:03:05 INFO 140590801676096] #early_stopping_criteria_metric: h
ost=algo-1, epoch=2, criteria=sampled_accuracy, value=0.999403110846
[11/11/2020 15:03:05 INFO 140590801676096] Epoch 2: Loss improved. Updating b
est model
[11/11/2020 15:03:05 INFO 140590801676096] Saving model for epoch: 2
[11/11/2020 15:03:05 INFO 140590801676096] Saved checkpoint to "/tmp/tmpNkJtT

```

```
N/mx-mod-0000.params"
[11/11/2020 15:03:05 INFO 140590801676096] #progress_metric: host=algo-1, completed 20 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Batches Since Last Reset": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Records Since Last Reset": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Total Batches Seen": {"count": 1, "max": 5, "sum": 5.0, "min": 5}, "Total Records Seen": {"count": 1, "max": 3910, "sum": 3910.0, "min": 3910}, "Max Records Seen Between Resets": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Reset Count": {"count": 1, "max": 5, "sum": 5.0, "min": 5}}, "EndTime": 1605106985.659734, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605106984.051363}

[11/11/2020 15:03:05 INFO 140590801676096] #throughput_metric: host=algo-1, train throughput=486.162407314 records/second
[2020-11-11 15:03:05.696] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 10, "duration": 36, "num_examples": 1, "num_bytes": 128248}
#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6040757903662484, "sum": 0.6040757903662484, "min": 0.6040757903662484}, "EndTime": 1605106985.696754, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106985.696635}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6544413066581082, "sum": 0.6544413066581082, "min": 0.6544413066581082}, "EndTime": 1605106985.696956, "Dimensions": {"model": 2, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106985.696935}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.3029700471921955, "sum": 0.3029700471921955, "min": 0.3029700471921955}, "EndTime": 1605106985.69711, "Dimensions": {"model": 4, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106985.697089}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.7079586409546835, "sum": 0.7079586409546835, "min": 0.7079586409546835}}, "EndTime": 1605106985.69867, "Dimensions": {"model": 28, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106985.698647}

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[11/11/2020 15:03:05 INFO 140590801676096] #quality_metric: host=algo-1, epoch=3, train binary_classification_cross_entropy_objective <loss>=0.604075790366
[2020-11-11 15:03:06.610] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 11, "duration": 884, "num_examples": 37, "num_bytes": 4670884}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.07258410755325027, "sum": 0.07258410755325027, "min": 0.07258410755325027}}, "EndTime": 1605106987.111819, "Dimensions": {"mode 1": 15, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106987.111804}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6441874287276701, "sum": 0.6441874287276701, "min": 0.6441874287276701}}, "EndTime": 1605106987.112011, "Dimensions": {"mode 1": 18, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106987.111993}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6924510106775542, "sum": 0.6924510106775542, "min": 0.6924510106775542}}, "EndTime": 1605106987.112075, "Dimensions": {"mode 1": 19, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106987.112058}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6504435949264284, "sum": 0.6504435949264284, "min": 0.6504435949264284}}, "EndTime": 1605106987.112398, "Dimensions": {"model": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106987.112381}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.7559169540118645, "sum": 0.7559169540118645, "min": 0.7559169540118645}}, "EndTime": 1605106987.112463, "Dimensions": {"model": 25, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106987.112446}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6961185761639201, "sum": 0.6961185761639201, "min": 0.6961185761639201}}, "EndTime": 1605106987.112524, "Dimensions": {"model": 26, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106987.112508}

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[11/11/2020 15:03:07 INFO 140590801676096] #quality_metric: host=algo-1, e poc
h=3, validation binary_classification_cross_entropy_objective <loss>=0.604090
746499
[11/11/2020 15:03:07 INFO 140590801676096] #early_stopping_criteria_metric: h
ost=algo-1, epoch=3, criteria=sampled_accuracy, value=0.999403110846
[11/11/2020 15:03:07 INFO 140590801676096] Epoch 3: Loss improved. Updating b
est model
[11/11/2020 15:03:07 INFO 140590801676096] Saving model for epoch: 3
[11/11/2020 15:03:07 INFO 140590801676096] Saved checkpoint to "/tmp/tmpWAVkZ
t/mx-mod-0000.params"
[11/11/2020 15:03:07 INFO 140590801676096] #progress_metric: host=algo-1, com
pleted 26 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 1,
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lgorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605106985.66005}

[11/11/2020 15:03:07 INFO 140590801676096] #throughput_metric: host=algo-1, t
rain throughput=535.830014917 records/second
[2020-11-11 15:03:07.149] [tensorio] [info] epoch_stats={"data_pipeline": "/o
pt/ml/input/data/train", "epoch": 12, "duration": 29, "num_examples": 1, "num
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.3461130439777813, "sum": 0.3461130439777813, "min": 0.3461130439777813}}, "EndTime": 1605106987.150354, "Dimensions": {"model": 5, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605106987.150335}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.3631503600293718, "sum": 0.3631503600293718, "min": 0.3631503600293718}}, "EndTime": 1605106987.150423, "Dimensions": {"model": 6, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605106987.150404}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.3557190956057185, "sum": 0.3557190956057185, "min": 0.3557190956057185}}, "EndTime": 1605106987.150495, "Dimensions": {"model": 7, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605106987.150476}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.62521463769781, "sum": 0.62521463769781, "min": 0.62521463769781}}, "EndTime": 1605106987.150564, "Dimensions": {"model": 8, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605106987.150545}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective":
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.3611791664377198, "sum": 0.3611791664377198, "min": 0.3611791664377198}}, "EndTime": 1605106987.150846, "Dimensions": {"model": 12, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605106987.150829}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.34507189504325847, "sum": 0.34507189504325847, "min": 0.34507189504325847}}, "EndTime": 1605106987.150969, "Dimensions": {"model": 14, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605106987.150951}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6791589449128836, "sum": 0.6791589449128836, "min": 0.6791589449128836}}, "EndTime": 1605106987.151293, "Dimensions": {"model": 19, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605106987.151275}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.3574019722316576, "sum": 0.3574019722316576, "min": 0.3574019722316576}}, "EndTime": 1605106987.151557, "Dimensions": {"model": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605106987.15154}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6683747664741848, "sum": 0.6683747664741848, "min": 0.6683747664741848}}, "EndTime": 1605106987.15163, "Dimensions": {"model": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605106987.151611}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.7407728424462516, "sum": 0.7407728424462516, "min": 0.7407728424462516}}, "EndTime": 1605106987.151701, "Dimensions": {"model": 25, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605106987.151682}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6988624514216353, "sum": 0.6988624514216353, "min": 0.6988624514216353}}, "EndTime": 1605106987.151928, "Dimensions": {"model": 29, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605106987.151913}
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[11/11/2020 15:03:07 INFO 140590801676096] #quality_metric: host=algo-1, epoch=4, train binary_classification_cross_entropy_objective <loss>=0.585551152144
[2020-11-11 15:03:08.175] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 14, "duration": 1002, "num_examples": 37, "num_bytes": 4670884}
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[11/11/2020 15:03:08 INFO 140590801676096] #quality_metric: host=algo-1, epoch=4, validation_binary_classification_cross_entropy_objective <loss>=0.582712213844
[11/11/2020 15:03:08 INFO 140590801676096] #early_stopping_criteria_metric: host=algo-1, epoch=4, criteria=sampled_accuracy, value=0.999403110846
[11/11/2020 15:03:08 INFO 140590801676096] Epoch 4: Loss improved. Updating best model
[11/11/2020 15:03:08 INFO 140590801676096] Saving model for epoch: 4
[11/11/2020 15:03:08 INFO 140590801676096] Saved checkpoint to "/tmp/tmpDDmmdz/mx-mod-0000.params"
[11/11/2020 15:03:08 INFO 140590801676096] #progress_metric: host=algo-1, completed 33 % of epochs
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[11/11/2020 15:03:08 INFO 140590801676096] #throughput_metric: host=algo-1, t
rain throughput=504.683824662 records/second
[2020-11-11 15:03:08.706] [tensorio] [info] epoch_stats={"data_pipeline": "/o
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.7873158954903293, "sum": 0.7873158954903293, "min": 0.7873158954903293}}, "EndTime": 1605106988.708563, "Dimensions": {"model": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 5}, "StartTime": 1605106988.708547}

[11/11/2020 15:03:08 INFO 140590801676096] #quality_metric: host=algo-1, epoch=5, train binary_classification_cross_entropy_objective <loss>=0.568072384886
[2020-11-11 15:03:09.702] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 17, "duration": 972, "num_examples": 37, "num_bytes": 4670884}
#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5578013703685887, "sum": 0.5578013703685887, "min": 0.5578013703685887}}, "EndTime": 1605106990.188579, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 5}, "StartTime": 1605106990.18849}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6153042688366738, "sum": 0.6153042688366738, "min": 0.6153042688366738}}, "EndTime": 1605106990.188676, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 5}, "StartTime": 1605106990.18866}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5940253637901899, "sum": 0.5940253637901899, "min": 0.5940253637901899}}, "EndTime": 1605106990.189143, "Dimensions": {"mode1": 8, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 5}, "StartTime": 1605106990.189125}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6553058253928126, "sum": 0.6553058253928126, "min": 0.6553058253928126}}, "EndTime": 1605106990.189261, "Dimensions": {"mode1": 10, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 5}, "StartTime": 1605106990.189244}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5072576514054189, "sum": 0.5072576514054189, "min": 0.5072576514054189}}, "EndTime": 1605106990.190012, "Dimensions": {"mode1": 22, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 5}, "StartTime": 1605106990.189994}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4838299192591525, "sum": 0.4838299192591525, "min": 0.4838299192591525}}, "EndTime": 1605106990.19009, "Dimensions": {"mode1": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 5}, "StartTime": 1605106990.19007}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6687682883666893, "sum": 0.6687682883666893, "min": 0.6687682883666893}}, "EndTime": 1605106990.190163, "Dimensions": {"mode1": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 5}, "StartTime": 1605106990.190144}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.7307092351803958, "sum": 0.7307092351803958, "min": 0.7307092351803958}}, "EndTime": 1605106990.190238, "Dimensions": {"mode1": 25, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 5}, "StartTime": 1605106990.190219}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.682102400392408, "sum": 0.682102400392408, "min": 0.682102400392408}}, "EndTime": 1605106990.190376, "Dimensions": {"model": 27, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 5}, "StartTime": 1605106990.190357}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5249801131598355, "sum": 0.5249801131598355, "min": 0.5249801131598355}}, "EndTime": 1605106990.190591, "Dimensions": {"model": 1, "mode": 30, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 5}, "StartTime": 1605106990.190573}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.8728575751518693, "sum": 0.8728575751518693, "min": 0.8728575751518693}}, "EndTime": 1605106990.190658, "Dimensions": {"model": 1, "mode": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 5}, "StartTime": 1605106990.19064}

[11/11/2020 15:03:10 INFO 140590801676096] #quality_metric: host=algo-1, epoch=5, validation_binary_classification_cross_entropy_objective <loss>=0.557801370369
[11/11/2020 15:03:10 INFO 140590801676096] #early_stopping_criteria_metric: host=algo-1, epoch=5, criteria=sampled_accuracy, value=0.999367999719
[11/11/2020 15:03:10 INFO 140590801676096] Epoch 5: Loss improved. Updating best model
[11/11/2020 15:03:10 INFO 140590801676096] Saving model for epoch: 5
[11/11/2020 15:03:10 INFO 140590801676096] Saved checkpoint to "/tmp/tmp1bYX3j/mx-mod-0000.params"
[11/11/2020 15:03:10 INFO 140590801676096] #progress_metric: host=algo-1, completed 40 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Batches Since Last Reset": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Records Since Last Reset": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Total Batches Seen": {"count": 1, "max": 8, "sum": 8.0, "min": 8}, "Total Records Seen": {"count": 1, "max": 6256, "sum": 6256.0, "min": 6256}, "Max Records Seen Between Resets": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Reset Count": {"count": 1, "max": 8, "sum": 8.0, "min": 8}}, "EndTime": 1605106990.197703, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 5}, "StartTime": 1605106988.669291}

[11/11/2020 15:03:10 INFO 140590801676096] #throughput_metric: host=algo-1, train throughput=511.59399229 records/second
[2020-11-11 15:03:10.235] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 16, "duration": 37, "num_examples": 1, "num_bytes": 128248}
#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5516892845368446, "sum": 0.5516892845368446, "min": 0.5516892845368446}}, "EndTime": 1605106990.236108, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605106990.236021}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.26129267465732897, "sum": 0.26129267465732897, "min": 0.26129267465732897}}, "EndTime": 1605106990.236349, "Dimensions": {"model": 4, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605106990.236337}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.563371351003037, "sum": 0.563371351003037, "min": 0.563371351003037}}, "EndTime": 1605106990.236694, "Dimensions": {"model": 11, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605106990.236682}
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[11/11/2020 15:03:10 INFO 140590801676096] #quality_metric: host=algo-1, epoch=6, train binary_classification_cross_entropy_objective <loss>=0.551689284537
[2020-11-11 15:03:11.174] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 20, "duration": 916, "num_examples": 37, "num_bytes": 4670884}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti  
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[11/11/2020 15:03:11 INFO 140590801676096] #quality_metric: host=algo-1, epoch=6, validation_binary_classification_cross_entropy_objective <loss>=0.532752551137
[11/11/2020 15:03:11 INFO 140590801676096] #early_stopping_criteria_metric: host=algo-1, epoch=6, criteria=sampled_accuracy, value=0.999227555212
[11/11/2020 15:03:11 INFO 140590801676096] Epoch 6: Loss improved. Updating best model
[11/11/2020 15:03:11 INFO 140590801676096] Saving model for epoch: 6
[11/11/2020 15:03:11 INFO 140590801676096] Saved checkpoint to "/tmp/tmpq1n40E/mx-mod-0000.params"
[11/11/2020 15:03:11 INFO 140590801676096] #progress_metric: host=algo-1, completed 46 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Batches Since Last Reset": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Records Since Last Reset": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Total Batches Seen": {"count": 1, "max": 9, "sum": 9.0, "min": 9}, "Total Records Seen": {"count": 1, "max": 9}}

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[11/11/2020 15:03:11 INFO 140590801676096] #throughput_metric: host=algo-1, train throughput=529.245616951 records/second
[2020-11-11 15:03:11.712] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 18, "duration": 36, "num_examples": 1, "num_bytes": 128248}
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[11/11/2020 15:03:11 INFO 140590801676096] #quality_metric: host=algo-1, epoch=7, train binary_classification_cross_entropy_objective <loss>=0.536454144646
[2020-11-11 15:03:12.802] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 23, "duration": 1066, "num_examples": 37, "num_bytes": 4670884}
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[11/11/2020 15:03:13 INFO 140590801676096] #quality_metric: host=algo-1, epoch=7, validation binary_classification_cross_entropy_objective <loss>=0.510308847748
[11/11/2020 15:03:13 INFO 140590801676096] #early_stopping_criteria_metric: host=algo-1, epoch=7, criteria=sampled_accuracy, value=0.999122221832
[11/11/2020 15:03:13 INFO 140590801676096] Epoch 7: Loss improved. Updating best model
[11/11/2020 15:03:13 INFO 140590801676096] Saving model for epoch: 7
[11/11/2020 15:03:13 INFO 140590801676096] Saved checkpoint to "/tmp/tmpcINULj/mx-mod-0000.params"
[11/11/2020 15:03:13 INFO 140590801676096] #progress_metric: host=algo-1, completed 53 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Batches Since Last Reset": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Records Since Last Reset": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Total Batches Seen": {"count": 1, "max": 10, "sum": 10.0, "min": 10}, "Total Records Seen": {"count": 1, "max": 7820, "sum": 7820.0, "min": 7820}, "Max Records Seen Between Resets": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Reset Count": {"count": 1, "max": 10, "sum": 10.0, "min": 10}}, "EndTime": 1605106993.304549, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 7}, "StartTime": 1605106991.675752}

[11/11/2020 15:03:13 INFO 140590801676096] #throughput_metric: host=algo-1, train throughput=480.066831092 records/second
[2020-11-11 15:03:13.342] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 20, "duration": 37, "num_examples": 1, "num_bytes": 128248}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5631547230283928, "sum": 0.5631547230283928, "min": 0.5631547230283928}}, "EndTime": 1605106993.343204, "Dimensions": {"model": 2, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 8}, "StartTime": 1605106993.343182}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.24139156487896618, "sum": 0.24139156487896618, "min": 0.24139156487896618}}, "EndTime": 1605106993.343503, "Dimensions": {"model": 6, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 8}, "StartTime": 1605106993.343483}

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[11/11/2020 15:03:13 INFO 140590801676096] #quality_metric: host=algo-1, epoch=8, train binary_classification_cross_entropy_objective <loss>=0.52231408629

2020-11-11 15:03:26 Uploading - Uploading generated training model [2020-11-11 15:03:14.279] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 26, "duration": 914, "num_examples": 37, "num_bytes": 4670884}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4921687545286153, "sum": 0.4921687545286153, "min": 0.4921687545286153}}, "EndTime": 1605106994.757931, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 8}, "StartTime": 1605106994.757844}

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[11/11/2020 15:03:14 INFO 140590801676096] #quality_metric: host=algo-1, epoch=8, validation_binary_classification_cross_entropy_objective <loss>=0.492168754529
[11/11/2020 15:03:14 INFO 140590801676096] #early_stopping_criteria_metric: host=algo-1, epoch=8, criteria=sampled_accuracy, value=0.999262666339
[11/11/2020 15:03:14 INFO 140590801676096] Epoch 8: Loss improved. Updating best model
[11/11/2020 15:03:14 INFO 140590801676096] Saving model for epoch: 8
[11/11/2020 15:03:14 INFO 140590801676096] Saved checkpoint to "/tmp/tmpQvv78y/mx-mod-0000.params"
[11/11/2020 15:03:14 INFO 140590801676096] #progress_metric: host=algo-1, completed 60 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Batches Since Last Reset": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Records Since Last Reset": {"count": 1, "max": 11, "sum": 11.0, "min": 11}, "Total Batches Seen": {"count": 1, "max": 11, "sum": 11.0, "min": 11}, "Total Records Seen": {"count": 1, "max": 8602, "sum": 8602.0, "min": 8602}, "Max Records Seen Between Resets": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Reset Count": {"count": 1, "max": 1, "sum": 1.0, "min": 1}}

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[11/11/2020 15:03:14 INFO 140590801676096] #throughput_metric: host=algo-1, train throughput=534.798203766 records/second
[2020-11-11 15:03:14.796] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 22, "duration": 29, "num_examples": 1, "num_bytes": 128248}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.2316000467676031, "sum": 0.2316000467676031, "min": 0.2316000467676031}}, "EndTime": 1605106994.797584, "Dimensions": {"model": 7, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5001733492097586, "sum": 0.5001733492097586, "min": 0.5001733492097586}}, "EndTime": 1605106994.797729, "Dimensions": {"model": 9, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106994.79771}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5214692332860454, "sum": 0.5214692332860454, "min": 0.5214692332860454}}, "EndTime": 1605106994.797862, "Dimensions": {"model": 11, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106994.797843}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.2392693248856098, "sum": 0.2392693248856098, "min": 0.2392693248856098}}, "EndTime": 1605106994.798127, "Dimensions": {"model": 15, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106994.798107}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5507347711821651, "sum": 0.5507347711821651, "min": 0.5507347711821651}}, "EndTime": 1605106994.798322, "Dimensions": {"model": 18, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106994.798304}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5850812516858815, "sum": 0.5850812516858815, "min": 0.5850812516858815}}, "EndTime": 1605106994.798398, "Dimensions": {"model": 19, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106994.798379}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.49503336172274615, "sum": 0.49503336172274615, "min": 0.49503336172274615}}, "EndTime": 1605106994.798663, "Dimensions": {"model": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106994.798645}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {
"count": 1, "max": 0.7077678865788842, "sum": 0.7077678865788842, "min": 0.7077678865788842}}, "EndTime": 1605106994.79907, "Dimensions": {"model": 28,
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {
"count": 1, "max": 0.6786118919587196, "sum": 0.6786118919587196, "min": 0.6786118919587196}}, "EndTime": 1605106994.799271, "Dimensions": {"model": 31,
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[11/11/2020 15:03:14 INFO 140590801676096] #quality_metric: host=algo-1, epoch=9, train binary_classification_cross_entropy_objective <loss>=0.509132209641
[2020-11-11 15:03:15.707] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 29, "duration": 887, "num_examples": 37, "num_bytes": 4670884}
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r", "epoch": 9}, "StartTime": 1605106996.272509}

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[11/11/2020 15:03:16 INFO 140590801676096] #quality_metric: host=algo-1, epoch=9, validation_binary_classification_cross_entropy_objective <loss>=0.478313665302
[11/11/2020 15:03:16 INFO 140590801676096] #early_stopping_criteria_metric: host=algo-1, epoch=9, criteria=sampled_accuracy, value=0.999332888592
[11/11/2020 15:03:16 INFO 140590801676096] Epoch 9: Loss improved. Updating best model
[11/11/2020 15:03:16 INFO 140590801676096] Saving model for epoch: 9
[11/11/2020 15:03:16 INFO 140590801676096] Saved checkpoint to "/tmp/tmpmcsJqr/mx-mod-0000.params"
[11/11/2020 15:03:16 INFO 140590801676096] #progress_metric: host=algo-1, completed 66 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Batches Since Last Reset": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Records Since Last Reset": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Total Batches Seen": {"count": 1, "max": 12, "sum": 12.0, "min": 12}, "Total Records Seen": {"count": 1, "max": 9384, "sum": 9384.0, "min": 9384}, "Max Records Seen Between Resets": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Reset Count": {"count": 1, "max": 12, "sum": 12.0, "min": 12}}, "EndTime": 1605106996.281457, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605106994.767264}

[11/11/2020 15:03:16 INFO 140590801676096] #throughput_metric: host=algo-1, train throughput=516.405470021 records/second
[2020-11-11 15:03:16.316] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 24, "duration": 34, "num_examples": 1, "num_bytes": 128248}
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[11/11/2020 15:03:16 INFO 140590801676096] #quality_metric: host=algo-1, epoch=10, train binary_classification_cross_entropy_objective <loss>=0.49679311767
[2020-11-11 15:03:17.328] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 32, "duration": 990, "num_examples": 37, "num_bytes": 4670884}
#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.46786887069535527, "sum": 0.46786887069535527, "min": 0.46786887069535527}}, "EndTime": 1605106997.812416, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605106997.812328}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.33594528047695515, "sum": 0.33594528047695515, "min": 0.33594528047695515}}, "EndTime": 1605106997.813398, "Dimensions": {"model": 15, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605106997.813384}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4782768403005032, "sum": 0.4782768403005032, "min": 0.4782768403005032}}, "EndTime": 1605106997.813461, "Dimensions": {"model": 16, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605106997.813445}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.24702207997191727, "sum": 0.24702207997191727, "min": 0.24702207997191727}}, "EndTime": 1605106997.813618, "Dimensions": {"mode1": 20, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605106997.813601}

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[11/11/2020 15:03:17 INFO 140590801676096] #quality_metric: host=algo-1, epoch=10, validation_binary_classification_cross_entropy_objective <loss>=0.467868870695
[11/11/2020 15:03:17 INFO 140590801676096] #early_stopping_criteria_metric: host=algo-1, epoch=10, criteria=sampled_accuracy, value=0.999087110705
[11/11/2020 15:03:17 INFO 140590801676096] Epoch 10: Loss improved. Updating best model
[11/11/2020 15:03:17 INFO 140590801676096] Saving model for epoch: 10
[11/11/2020 15:03:17 INFO 140590801676096] Saved checkpoint to "/tmp/tmp6N8kmJ/mx-mod-0000.params"
[11/11/2020 15:03:17 INFO 140590801676096] #progress_metric: host=algo-1, completed 73 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Batches Since Last Reset": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Records Since Last Reset": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Total Batches Seen": {"count": 1, "max": 13, "sum": 13.0, "min": 13}, "Total Records Seen": {"count": 1, "max": 10166, "sum": 10166.0, "min": 10166}, "Max Records Seen Between Resets": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Reset Count": {"count": 1, "max": 13, "sum": 13.0, "min": 13}}, "EndTime": 1605106997.821298, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "trainin

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[11/11/2020 15:03:17 INFO 140590801676096] #throughput_metric: host=algo-1, t
rain throughput=507.904035519 records/second
[2020-11-11 15:03:17.859] [tensorio] [info] epoch_stats={"data_pipeline": "/o
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.24305104599584398, "sum": 0.24305104599584398, "min": 0.24305104599584398}}, "EndTime": 1605106997.860521, "Dimensions": {"model": 15, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106997.860509}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.48534859659726665, "sum": 0.48534859659726665, "min": 0.48534859659726665}}, "EndTime": 1605106997.860568, "Dimensions": {"model": 16, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106997.860556}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5280324248096827, "sum": 0.5280324248096827, "min": 0.5280324248096827}}, "EndTime": 1605106997.860659, "Dimensions": {"model": 18, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106997.860647}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4940386135559863, "sum": 0.4940386135559863, "min": 0.4940386135559863}}, "EndTime": 1605106997.860781, "Dimensions": {"model": 20, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106997.860764}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.48574165675951086, "sum": 0.48574165675951086, "min": 0.48574165675951086}}, "EndTime": 1605106997.860845, "Dimensions": {"model": 21, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106997.860828}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4298706835188219, "sum": 0.4298706835188219, "min": 0.4298706835188219}}, "EndTime": 1605106997.860901, "Dimensions": {"model": 22, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106997.860898}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4405427820542279, "sum": 0.4405427820542279, "min": 0.4405427820542279}}, "EndTime": 1605106997.860945, "Dimensions": {"model": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106997.860936}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6877215841542119, "sum": 0.6877215841542119, "min": 0.6877215841542119}}, "EndTime": 1605106997.860986, "Dimensions": {"model": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106997.860972}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective":
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  {"count": 1, "max": 0.6715681071171675, "sum": 0.6715681071171675, "min": 0.
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective":
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective":
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective":
  {"count": 1, "max": 0.6734535627048034, "sum": 0.6734535627048034, "min": 0.
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[11/11/2020 15:03:17 INFO 140590801676096] #quality_metric: host=algo-1, epoc
h=11, train binary_classification_cross_entropy_objective <loss>=0.4853584309
06
[2020-11-11 15:03:18.731] [tensorio] [info] epoch_stats={"data_pipeline": "/o
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7, "num_bytes": 4670884}
#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.2831657955868434, "sum": 0.2831657955868434, "min": 0.2831657955868434}, "EndTime": 1605106999.233347, "Dimensions": {"mode1": 5, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106999.233327}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.29388604693682163, "sum": 0.29388604693682163, "min": 0.29388604693682163}, "EndTime": 1605106999.233422, "Dimensions": {"mode1": 6, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106999.233402}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.2999802634922048, "sum": 0.2999802634922048, "min": 0.2999802634922048}, "EndTime": 1605106999.233502, "Dimensions": {"mode1": 7, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106999.233481}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.457394125873355, "sum": 0.457394125873355, "min": 0.457394125873355}, "EndTime": 1605106999.233656, "Dimensions": {"model": 9, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106999.233638}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5377265172352772, "sum": 0.5377265172352772, "min": 0.5377265172352772}, "EndTime": 1605106999.233732, "Dimensions": {"mode1": 10, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106999.233713}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.270508087877184, "sum": 0.270508087877184, "min": 0.270508087877184}}, "EndTime": 1605106999.234002, "Dimensions": {"model": 14, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106999.233981}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.3272731402362231, "sum": 0.3272731402362231, "min": 0.3272731402362231}}, "EndTime": 1605106999.234076, "Dimensions": {"mode 1": 15, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106999.234058}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.46455798348844407, "sum": 0.46455798348844407, "min": 0.46455798348844407}}, "EndTime": 1605106999.234147, "Dimensions": {"mode 1": 16, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106999.234128}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.526495652563606, "sum": 0.526495652563606, "min": 0.526495652563606}}, "EndTime": 1605106999.234316, "Dimensions": {"model": 19, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106999.234299}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.2542174473801991, "sum": 0.2542174473801991, "min": 0.2542174473801991}}, "EndTime": 1605106999.234378, "Dimensions": {"mode 1": 20, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106999.234361}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.2719558705641003, "sum": 0.2719558705641003, "min": 0.2719558705641003}}, "EndTime": 1605106999.234513, "Dimensions": {"mode1": 22, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106999.234494}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.2503302734113552, "sum": 0.2503302734113552, "min": 0.2503302734113552}}, "EndTime": 1605106999.234589, "Dimensions": {"mode1": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106999.23457}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6903644231073869, "sum": 0.6903644231073869, "min": 0.6903644231073869}}, "EndTime": 1605106999.234655, "Dimensions": {"mode1": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106999.234637}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6840484861301106, "sum": 0.6840484861301106, "min": 0.6840484861301106}}, "EndTime": 1605106999.234713, "Dimensions": {"mode1": 25, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106999.234699}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6716683374596908, "sum": 0.6716683374596908, "min": 0.6716683374596908}}, "EndTime": 1605106999.234785, "Dimensions": {"mode1": 26, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106999.234745}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6472916785746762, "sum": 0.6472916785746762, "min": 0.6472916785746762}}, "EndTime": 1605106999.23497, "Dimensions": {"mode1": 29, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106999.234958}

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[11/11/2020 15:03:19 INFO 140590801676096] #quality_metric: host=algo-1, epoch=11, validation_binary_classification_cross_entropy_objective <loss>=0.459605221433
[11/11/2020 15:03:19 INFO 140590801676096] #early_stopping_criteria_metric: host=algo-1, epoch=11, criteria=sampled_accuracy, value=0.999087110705
[11/11/2020 15:03:19 INFO 140590801676096] Epoch 11: Loss improved. Updating best model
[11/11/2020 15:03:19 INFO 140590801676096] Saving model for epoch: 11
[11/11/2020 15:03:19 INFO 140590801676096] Saved checkpoint to "/tmp/tmpoNe8TY/mx-mod-0000.params"
[11/11/2020 15:03:19 INFO 140590801676096] #progress_metric: host=algo-1, completed 80 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Batches Since Last Reset": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Records Since Last Reset": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Total Batches Seen": {"count": 1, "max": 14, "sum": 14.0, "min": 14}, "Total Records Seen": {"count": 1, "max": 10948, "sum": 10948.0, "min": 10948}, "Max Records Seen Between Resets": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Reset Count": {"count": 1, "max": 14, "sum": 14.0, "min": 14}, "EndTime": 1605106999.241748, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 11}, "StartTime": 1605106997.821642}

[11/11/2020 15:03:19 INFO 140590801676096] #throughput_metric: host=algo-1, train throughput=550.60805056 records/second
[2020-11-11 15:03:19.272] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 28, "duration": 30, "num_examples": 1, "num_bytes": 128248}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5211658136314138, "sum": 0.5211658136314138, "min": 0.5211658136314138}, "EndTime": 1605106999.272693, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 12}, "StartTime": 1605106999.27267}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.50963223742707, "sum": 0.50963223742707, "min": 0.50963223742707}, "EndTime": 1605106999.272791, "Dimensions": {"model": 2, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 12}, "StartTime": 1605106999.272769}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5214615063289242, "sum": 0.5214615063289242, "min": 0.5214615063289242}, "EndTime": 1605106999.272867, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 12}, "StartTime": 1605106999.272849}

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[2020-11-11 15:03:20.309] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 38, "duration": 1017, "num_examples": 37, "num_bytes": 4670884}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.7896006598800241, "sum": 0.7896006598800241, "min": 0.7896006598800241}}, "EndTime": 1605107000.799203, "Dimensions": {"model": 1": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 12}, "StartTime": 1605107000.799186}

[11/11/2020 15:03:20 INFO 140590801676096] #quality_metric: host=algo-1, epoch=12, validation_binary_classification_cross_entropy_objective <loss>=0.452516767342
[11/11/2020 15:03:20 INFO 140590801676096] #early_stopping_criteria_metric: host=algo-1, epoch=12, criteria=sampled_accuracy, value=0.999297777466
[11/11/2020 15:03:20 INFO 140590801676096] Epoch 12: Loss improved. Updating best model
[11/11/2020 15:03:20 INFO 140590801676096] Saving model for epoch: 12
[11/11/2020 15:03:20 INFO 140590801676096] Saved checkpoint to "/tmp/tmp7oonQp/mx-mod-0000.params"
[11/11/2020 15:03:20 INFO 140590801676096] #progress_metric: host=algo-1, completed 86 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Batches Since Last Reset": {"count": 1, "max": 1, "sum": 1.0, "min": 1}, "Number of Records Since Last Reset": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Total Batches Seen": {"count": 1, "max": 15, "sum": 15.0, "min": 15}, "Total Records Seen": {"count": 1, "max": 11730, "sum": 11730.0, "min": 11730}, "Max Records Seen Between Resets": {"count": 1, "max": 782, "sum": 782.0, "min": 782}, "Reset Count": {"count": 1, "max": 15, "sum": 15.0, "min": 15}}, "EndTime": 1605107000.806243, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "trainin g", "Algorithm": "Linear Learner", "epoch": 12}, "StartTime": 1605106999.242105}

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[11/11/2020 15:03:20 INFO 140590801676096] #throughput_metric: host=algo-1, t  
rain throughput=499.905386463 records/second  
[2020-11-11 15:03:20.844] [tensorio] [info] epoch_stats={"data_pipeline": "/o  
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_bytes": 128248}  
#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective":  
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective":  
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.21193082375294717, "sum": 0.21193082375294717, "min": 0.21193082375294717}}, "EndTime": 1605107000.845229, "Dimensions": {"model": 13, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107000.845217}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5089631531854419, "sum": 0.5089631531854419, "min": 0.5089631531854419}}, "EndTime": 1605107000.845475, "Dimensions": {"model": 18, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107000.845459}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5318302632597707, "sum": 0.5318302632597707, "min": 0.5318302632597707}}, "EndTime": 1605107000.845524, "Dimensions": {"model": 19, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107000.845508}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.47462486793927827, "sum": 0.47462486793927827, "min": 0.47462486793927827}}, "EndTime": 1605107000.845627, "Dimensions": {"model": 21, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107000.845612}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4020874335637788, "sum": 0.4020874335637788, "min": 0.4020874335637788}}, "EndTime": 1605107000.845726, "Dimensions": {"model": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107000.845714}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6876228508132193, "sum": 0.6876228508132193, "min": 0.6876228508132193}}, "EndTime": 1605107000.845779, "Dimensions": {"model": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107000.845768}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6655044750789242, "sum": 0.6655044750789242, "min": 0.6655044750789242}}, "EndTime": 1605107000.846038, "Dimensions": {"model": 29, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107000.846022}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6416430851382673, "sum": 0.6416430851382673, "min": 0.6416430851382673}}, "EndTime": 1605107000.846097, "Dimensions": {"model": 30, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107000.846081}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.7071066463694853, "sum": 0.7071066463694853, "min": 0.7071066463694853}}, "EndTime": 1605107000.84615, "Dimensions": {"model": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107000.846136}

[11/11/2020 15:03:20 INFO 140590801676096] #quality_metric: host=algo-1, epoch=13, train binary_classification_cross_entropy_objective <loss>=0.464730382271
[2020-11-11 15:03:21.803] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 41, "duration": 939, "num_examples": 37, "num_bytes": 4670884}
#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4456863266703227, "sum": 0.4456863266703227, "min": 0.4456863266703227}}, "EndTime": 1605107002.285375, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107002.285288}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.48418859482682125, "sum": 0.48418859482682125, "min": 0.48418859482682125}}, "EndTime": 1605107002.285473, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107002.285454}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.47506776818197466, "sum": 0.47506776818197466, "min": 0.47506776818197466}}, "EndTime": 1605107002.285556, "Dimensions": {"model": 2, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107002.285536}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.488689352557681, "sum": 0.488689352557681, "min": 0.488689352557681}}

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0.488689352557681}}, "EndTime": 1605107002.285633, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107002.285614}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.472809702596413, "sum": 0.472809702596413, "min": 0.472809702596413}}, "EndTime": 1605107002.285952, "Dimensions": {"model": 8, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107002.285934}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.42924354644032836, "sum": 0.42924354644032836, "min": 0.42924354644032836}}, "EndTime": 1605107002.286011, "Dimensions": {"mode": 1": 9, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107002.285994}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.5171916502663303, "sum": 0.5171916502663303, "min": 0.5171916502663303}}, "EndTime": 1605107002.286077, "Dimensions": {"mode": 1": 10, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107002.28606}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4431377740510875, "sum": 0.4431377740510875, "min": 0.4431377740510875}}, "EndTime": 1605107002.286145, "Dimensions": {"mode": 1": 11, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107002.286127}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.2064037412067029, "sum": 0.2064037412067029, "min": 0.2064037412067029}}, "EndTime": 1605107002.286267, "Dimensions": {"mode1": 13, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107002.28625}

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[11/11/2020 15:03:22 INFO 140590801676096] #quality_metric: host=algo-1, epoch=13, validation binary_classification_cross_entropy_objective <loss>=0.44568632667
[11/11/2020 15:03:22 INFO 140590801676096] #early_stopping_criteria_metric: host=algo-1, epoch=13, criteria=sampled_accuracy, value=0.999403110846
[11/11/2020 15:03:22 INFO 140590801676096] Epoch 13: Loss improved. Updating best model
[11/11/2020 15:03:22 INFO 140590801676096] Saving model for epoch: 13
[11/11/2020 15:03:22 INFO 140590801676096] Saved checkpoint to "/tmp/tmpUpVF5/mx-mod-0000.params"
[11/11/2020 15:03:22 INFO 140590801676096] #progress_metric: host=algo-1, completed 93 % of epochs
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[11/11/2020 15:03:22 INFO 140590801676096] #throughput_metric: host=algo-1, train throughput=525.525286116 records/second
[2020-11-11 15:03:22.332] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 32, "duration": 37, "num_examples": 1, "num_bytes": 128248}
#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4554660338574968, "sum": 0.4554660338574968, "min": 0.4554660338574968}}, "EndTime": 1605107002.332764, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107002.332682}

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[11/11/2020 15:03:22 INFO 140590801676096] #quality_metric: host=algo-1, epoch=14, train binary_classification_cross_entropy_objective <loss>=0.455466033857
[2020-11-11 15:03:23.362] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 44, "duration": 1010, "num_examples": 37, "num_bytes": 4670884}
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[11/11/2020 15:03:23 INFO 140590801676096] #early_stopping_criteria_metric: host=algo-1, epoch=14, criteria=sampled_accuracy, value=0.999297777466
[11/11/2020 15:03:23 INFO 140590801676096] Epoch 14: Loss improved. Updating best model
[11/11/2020 15:03:23 INFO 140590801676096] Saving model for epoch: 14
[11/11/2020 15:03:23 INFO 140590801676096] Saved checkpoint to "/tmp/tmpbuV1q2/mx-mod-0000.params"
[11/11/2020 15:03:23 INFO 140590801676096] #progress_metric: host=algo-1, completed 100 % of epochs
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[11/11/2020 15:03:23 INFO 140590801676096] #throughput_metric: host=algo-1, t

```

```
rain throughput=501.880434495 records/second
[11/11/2020 15:03:23 WARNING 140590801676096] wait_for_all_workers will not sync workers since the kv store is not running distributed
[11/11/2020 15:03:23 WARNING 140590801676096] wait_for_all_workers will not sync workers since the kv store is not running distributed
[2020-11-11 15:03:24.751] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 47, "duration": 881, "num_examples": 37, "num_bytes": 4670884}
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[2020-11-11 15:03:25.369] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 49, "duration": 124, "num_examples": 37, "num_bytes": 4670884}
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[11/11/2020 15:03:25 INFO 140590801676096] #validation_score (algo-1) : ('binary_classification_accuracy', 0.9992626663389628)
[11/11/2020 15:03:25 INFO 140590801676096] #validation_score (algo-1) : ('binary_f_1.000', 0.8108108108109)
[11/11/2020 15:03:25 INFO 140590801676096] #validation_score (algo-1) : ('precision', 0.8035714285714286)
[11/11/2020 15:03:25 INFO 140590801676096] #validation_score (algo-1) : ('recall', 0.8181818181818182)
[11/11/2020 15:03:25 INFO 140590801676096] #validation_score (algo-1) : ('roc_auc_score', 0.9654298561496197)
[11/11/2020 15:03:25 INFO 140590801676096] #quality_metric: host=algo-1, validation binary_classification_cross_entropy <loss>=0.463608717082
[11/11/2020 15:03:25 INFO 140590801676096] #quality_metric: host=algo-1, validation binary_classification_accuracy <score>=0.999262666339
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[11/11/2020 15:03:25 INFO 140590801676096] #quality_metric: host=algo-1, validation precision <score>=0.803571428571
[11/11/2020 15:03:25 INFO 140590801676096] #quality_metric: host=algo-1, validation recall <score>=0.818181818182
[11/11/2020 15:03:25 INFO 140590801676096] #quality_metric: host=algo-1, validation roc_auc_score <score>=0.96542985615
[11/11/2020 15:03:25 INFO 140590801676096] Best model found for hyperparameters: {"lr_scheduler_step": 10, "wd": 1, "optimizer": "adam", "lr_scheduler_factor": 0.99, "l1": 0.0, "learning_rate": 0.1, "lr_scheduler_minimum_lr": 0.0001}
[11/11/2020 15:03:25 INFO 140590801676096] Saved checkpoint to "/tmp/tmpAECwxK/mx-mod-0000.params"
[2020-11-11 15:03:25.384] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/test", "epoch": 0, "duration": 25338, "num_examples": 1, "num_bytes": 128248}
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[11/11/2020 15:03:25 INFO 140590801676096] #test_score (algo-1) : ('binary_classification_cross_entropy_objective', 0.46381023906974167)
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[11/11/2020 15:03:25 INFO 140590801676096] #test_score (algo-1) : ('binary_f_1.000', 0.7727272727272727)
[11/11/2020 15:03:25 INFO 140590801676096] #test_score (algo-1) : ('precision', 0.8095238095238095)
[11/11/2020 15:03:25 INFO 140590801676096] #test_score (algo-1) : ('recall', 0.7391304347826086)
[11/11/2020 15:03:25 INFO 140590801676096] #test_score (algo-1) : ('roc_auc_score', 0.9710889060481189)
[11/11/2020 15:03:25 INFO 140590801676096] #quality_metric: host=algo-1, test binary_classification_cross_entropy_objective <loss>=0.46381023907
[11/11/2020 15:03:25 INFO 140590801676096] #quality_metric: host=algo-1, test binary_classification_accuracy <score>=0.999297777466
[11/11/2020 15:03:25 INFO 140590801676096] #quality_metric: host=algo-1, test binary_f_1.000 <score>=0.772727272727
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[11/11/2020 15:03:25 INFO 140590801676096] #quality_metric: host=algo-1, test recall <score>=0.739130434783
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2020-11-11 15:03:33 Completed - Training job completed
Training seconds: 70
Billable seconds: 70



Reducing the number of examples that make the distribution even caused the recall to go down rather than up.
Let's try a different strategy, because we need a high recall.

Try using SMOTE to increase the number of positive examples.

```
In [47]: from imblearn.over_sampling import SMOTE  
  
X = df.drop(['Class', 'Time'], axis=1).values  
y = df['Class'].values  
  
sm = SMOTE(random_state=35)  
X_res, y_res = sm.fit_resample(X, y)
```

Using MXNet backend

Optional: Convert the new dataset to a Pandas DataFrame and check the shape and distribution of the data.

```
In [48]: smote_df = pd.DataFrame(X_res, columns = df.drop(['Class', 'Time'], axis=1).columns)  
smote_df['Class'] = y_res  
smote_df['Time'] = df['Time']
```

Create new train, test, and validation datasets.

```
In [49]: #X_res, y_res = X_res.astype("float32"), y_res.astype("float32")  
  
train_features, test_features, train_labels, test_labels, val_features, val_labels = create_training_sets(smote_df)
```

Train your model using the new dataset.

```
In [50]: num_classes = len(pd.unique(train_labels))
linear_estimator_smote = sagemaker.LinearLearner(role=sagemaker.get_execution_
role(),
                                                 instance_count=1,
                                                 instance_type='ml.m4.xlarge',
                                                 predictor_type='binary_classifi
er')

train_records_smote = linear_estimator_smote.record_set(train_features, train_
labels, channel='train')
val_records_smote = linear_estimator_smote.record_set(val_features, val_labels
, channel='validation')
test_records_smote = linear_estimator_smote.record_set(test_features, test_lab
els, channel='test')

linear_estimator_smote.fit([train_records_smote, val_records_smote, test_recor
ds_smote])
```

Defaulting to the only supported framework/algorithm version: 1. Ignoring framework/algorithm version: 1.

Defaulting to the only supported framework/algorithm version: 1. Ignoring framework/algorithm version: 1.

```
2020-11-11 15:04:34 Starting - Starting the training job...
2020-11-11 15:04:36 Starting - Launching requested ML instances.....
2020-11-11 15:06:04 Starting - Preparing the instances for training.....
2020-11-11 15:07:22 Downloading - Downloading input data.....
2020-11-11 15:08:29 Training - Training image download completed. Training in
progress..Docker entrypoint called with argument(s): train
Running default environment configuration script
[11/11/2020 15:08:34 INFO 140525173397312] Reading default configuration from
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a': u'accuracy', u'use_lr_scheduler': u'true', u'target_precision': u'0.8',
u'unbias_data': u'auto', u'init_scale': u'0.07', u'bias_wd_mult': u'auto',
u'f_beta': u'1.0', u'mini_batch_size': u'1000', u'huber_delta': u'1.0', u'nu
m_classes': u'1', u'beta_1': u'auto', u'loss': u'auto', u'beta_2': u'auto',
u'_enable_profiler': u>false', u'normalize_label': u'auto', u'_num_gpus':
u'auto', u'balance_multiclass_weights': u>false', u'positive_example_weight_
mult': u'1.0', u'l1': u'auto', u'margin': u'1.0'}
[11/11/2020 15:08:34 INFO 140525173397312] Merging with provided configuratio
n from /opt/ml/input/config/hyperparameters.json: {u'feature_dim': u'29', u'm
ini_batch_size': u'1000', u'predictor_type': u'binary_classifier'}
[11/11/2020 15:08:34 INFO 140525173397312] Final configuration: {u'loss_insen
sitivity': u'0.01', u'epochs': u'15', u'feature_dim': u'29', u'init_bias':
u'0.0', u'lr_scheduler_factor': u'auto', u'num_calibration_samples': u'10000
000', u'accuracy_top_k': u'3', u'_num_kv_servers': u'auto', u'use_bias': u'tr
ue', u'num_point_for_scaler': u'10000', u'_log_level': u'info', u'quantile':
u'0.5', u'bias_lr_mult': u'auto', u'lr_scheduler_step': u'auto', u'init_meth
od': u'uniform', u'init_sigma': u'0.01', u'lr_scheduler_minimum_lr': u'auto',
u'target_recall': u'0.8', u'num_models': u'auto', u'early_stopping_patience':
u'3', u'momentum': u'auto', u'unbias_label': u'auto', u'wd': u'auto', u'optim
izer': u'auto', u'_tuning_objective_metric': u'', u'early_stopping_toleranc
e': u'0.001', u'learning_rate': u'auto', u'_kvstore': u'auto', u'normalize_da
ta': u'true', u'binary_classifier_model_selection_criteria': u'accuracy', u'u
se_lr_scheduler': u'true', u'target_precision': u'0.8', u'unbias_data': u'aut
o', u'init_scale': u'0.07', u'bias_wd_mult': u'auto', u'f_beta': u'1.0', u'mi
ni_batch_size': u'1000', u'huber_delta': u'1.0', u'num_classes': u'1', u'pred
ictor_type': u'binary_classifier', u'beta_1': u'auto', u'loss': u'auto', u'be
ta_2': u'auto', u'_enable_profiler': u>false', u'normalize_label': u'auto',
u'_num_gpus': u'auto', u'balance_multiclass_weights': u>false', u'positive_e
xample_weight_mult': u'1.0', u'l1': u'auto', u'margin': u'1.0'}
[11/11/2020 15:08:34 WARNING 140525173397312] Loggers have already been setu
p.
Process 1 is a worker.
[11/11/2020 15:08:34 INFO 140525173397312] Using default worker.
[11/11/2020 15:08:34 INFO 140525173397312] Checkpoint loading and saving are
disabled.
```

```
[2020-11-11 15:08:34.334] [tensorio] [warning] TensorIO is already initialize
d; ignoring the initialization routine.
[2020-11-11 15:08:34.340] [tensorio] [warning] TensorIO is already initialize
d; ignoring the initialization routine.
[2020-11-11 15:08:34.386] [tensorio] [info] epoch_stats={"data_pipeline": "/o
pt/ml/input/data/train", "epoch": 0, "duration": 55, "num_examples": 1, "num_
bytes": 164000}
[11/11/2020 15:08:34 INFO 140525173397312] Create Store: local
[2020-11-11 15:08:34.503] [tensorio] [info] epoch_stats={"data_pipeline": "/o
pt/ml/input/data/train", "epoch": 1, "duration": 116, "num_examples": 11, "nu
m_bytes": 1804000}
[11/11/2020 15:08:34 INFO 140525173397312] Scaler algorithm parameters
<algorithm.scaler.ScalerAlgorithmStable object at 0x7fce317bd750>
[11/11/2020 15:08:34 INFO 140525173397312] Scaling model computed with parame
ters:
{'stdev_weight':
[ 5.6194696  3.7628207  6.2887077  3.1173253  4.2548785
 1.6912946  5.813641   4.7450724  2.249503   4.444221
 2.6882377  4.454185   0.98173064 4.529941   0.9183304
 3.3814845  5.793666   2.3341126  1.2184156  1.0713745
 2.6754093  1.1149671  1.0985525  0.54133785 0.63510215
 0.45126432 0.9901277  0.3927256  275.0939   ]
<NDArray 29 @cpu(0)>, 'stdev_label': None, 'mean_label': None, 'mean_weight':
[-2.4118764e+00  1.8588054e+00 -3.5911274e+00  2.2930069e+00
 -1.6367519e+00 -7.0975393e-01 -2.7974033e+00  3.7048018e-01
 -1.3107744e+00 -2.8895721e+00  1.9240240e+00 -3.1488702e+00
 -6.9006920e-02 -3.5454383e+00 -3.8889438e-02 -2.0692904e+00
 -3.3309577e+00 -1.1183206e+00  3.2394639e-01  1.9489472e-01
 3.4631246e-01 -1.2852671e-03 -1.5283891e-02 -6.1039072e-02
 4.5982361e-02  2.5242660e-02  8.1060573e-02  3.9193992e-02
 1.0646600e+02]
<NDArray 29 @cpu(0)>}
[11/11/2020 15:08:34 INFO 140525173397312] nvidia-smi took: 0.0251948833466 s
ecs to identify 0 gpus
[11/11/2020 15:08:34 INFO 140525173397312] Number of GPUs being used: 0
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max":
11, "sum": 11.0, "min": 11}, "Number of Batches Since Last Reset": {"count":
1, "max": 0, "sum": 0.0, "min": 0}, "Number of Records Since Last Reset": {"c
ount": 1, "max": 0, "sum": 0.0, "min": 0}, "Total Batches Seen": {"count": 1,
"max": 12, "sum": 12.0, "min": 12}, "Total Records Seen": {"count": 1, "max":
12000, "sum": 12000.0, "min": 12000}, "Max Records Seen Between Resets": {"c
ount": 1, "max": 11000, "sum": 11000.0, "min": 11000}, "Reset Count": {"coun
t": 1, "max": 2, "sum": 2.0, "min": 2}}, "EndTime": 1605107314.610839, "Dimen
sions": {"Host": "algo-1", "Meta": "init_train_data_iter", "Operation": "trai
ning", "Algorithm": "Linear Learner"}, "StartTime": 1605107314.610795}

[2020-11-11 15:08:48.956] [tensorio] [info] epoch_stats={"data_pipeline": "/o
pt/ml/input/data/train", "epoch": 3, "duration": 14345, "num_examples": 455,
"num_bytes": 74604256}
#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective":
{"count": 1, "max": 0.22806539725417083, "sum": 0.22806539725417083, "min":
0.22806539725417083}}, "EndTime": 1605107328.956457, "Dimensions": {"model":
0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner",
"epoch": 0}, "StartTime": 1605107328.956365}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective":
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{"count": 1, "max": 0.2332097530280966, "sum": 0.2332097530280966, "min": 0.2332097530280966}, "EndTime": 1605107328.956546, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.956526}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.2376790397744872, "sum": 0.2376790397744872, "min": 0.2376790397744872}, "EndTime": 1605107328.956613, "Dimensions": {"model": 2, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.956595}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.23467930895431452, "sum": 0.23467930895431452, "min": 0.23467930895431452}, "EndTime": 1605107328.956673, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.956657}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.12694498818351307, "sum": 0.12694498818351307, "min": 0.12694498818351307}, "EndTime": 1605107328.956736, "Dimensions": {"model": 4, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.956719}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.12466353482821964, "sum": 0.12466353482821964, "min": 0.12466353482821964}, "EndTime": 1605107328.956774, "Dimensions": {"model": 5, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.956765}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1258092512223164, "sum": 0.1258092512223164, "min": 0.1258092512223164}, "EndTime": 1605107328.95681, "Dimensions": {"model": 6, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.956798}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1257824568223323, "sum": 0.1257824568223323, "min": 0.1257824568223323}, "EndTime": 1605107328.95687, "Dimensions": {"model": 7, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.956854}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.23958381904904538, "sum": 0.23958381904904538, "min": 0.23958381904904538}, "EndTime": 1605107328.956934, "Dimensions": {"model": 8, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.956916}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.22641586727192747, "sum": 0.22641586727192747, "min": 0.22641586727192747}, "EndTime": 1605107328.956994, "Dimensions": {"model": 9, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.956978}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.2500529507876493, "sum": 0.2500529507876493, "min": 0.2500529507876493}, "EndTime": 1605107328.957054, "Dimensions": {"model": 10,
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"Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.957038}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.23027423035205724, "sum": 0.23027423035205724, "min": 0.23027423035205724}}, "EndTime": 1605107328.957116, "Dimensions": {"model": 11, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.957099}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1516122944365514, "sum": 0.1516122944365514, "min": 0.1516122944365514}}, "EndTime": 1605107328.957169, "Dimensions": {"model": 12, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.957158}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1522614951112722, "sum": 0.1522614951112722, "min": 0.1522614951112722}}, "EndTime": 1605107328.957223, "Dimensions": {"model": 13, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.957207}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1510700828451417, "sum": 0.1510700828451417, "min": 0.1510700828451417}}, "EndTime": 1605107328.957279, "Dimensions": {"model": 14, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.957265}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.15258016265331387, "sum": 0.15258016265331387, "min": 0.15258016265331387}}, "EndTime": 1605107328.957337, "Dimensions": {"model": 15, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.957321}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4093900959166136, "sum": 0.4093900959166136, "min": 0.4093900959166136}}, "EndTime": 1605107328.957394, "Dimensions": {"model": 16, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.957378}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4133524514084871, "sum": 0.4133524514084871, "min": 0.4133524514084871}}, "EndTime": 1605107328.957453, "Dimensions": {"model": 17, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.957437}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4128395930890995, "sum": 0.4128395930890995, "min": 0.4128395930890995}}, "EndTime": 1605107328.957491, "Dimensions": {"model": 18, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.957482}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.41445179647706154, "sum": 0.41445179647706154, "min": 0.41445179647706154}}, "EndTime": 1605107328.957548, "Dimensions": {"model": 19, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.957532}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40664024030374535, "sum": 0.40664024030374535, "min": 0.40664024030374535}}, "EndTime": 1605107328.95761, "Dimensions": {"model": 20, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.957592}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40685469727369133, "sum": 0.40685469727369133, "min": 0.40685469727369133}}, "EndTime": 1605107328.957679, "Dimensions": {"model": 21, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.957661}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40631518225312757, "sum": 0.40631518225312757, "min": 0.40631518225312757}}, "EndTime": 1605107328.957743, "Dimensions": {"model": 22, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.957725}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40671671614457855, "sum": 0.40671671614457855, "min": 0.40671671614457855}}, "EndTime": 1605107328.957808, "Dimensions": {"model": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.957791}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6807440439635961, "sum": 0.6807440439635961, "min": 0.6807440439635961}}, "EndTime": 1605107328.957875, "Dimensions": {"model": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.957857}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6817828523745095, "sum": 0.6817828523745095, "min": 0.6817828523745095}}, "EndTime": 1605107328.957965, "Dimensions": {"model": 25, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.957946}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.680898311530966, "sum": 0.680898311530966, "min": 0.680898311530966}}, "EndTime": 1605107328.958059, "Dimensions": {"model": 26, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.958041}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6808430513222312, "sum": 0.6808430513222312, "min": 0.6808430513222312}}, "EndTime": 1605107328.95812, "Dimensions": {"model": 27, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.958102}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6825651815137149, "sum": 0.6825651815137149, "min": 0.6825651815137149}}, "EndTime": 1605107328.95818, "Dimensions": {"model": 28, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.958162}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective":
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{"count": 1, "max": 0.6827695660696156, "sum": 0.6827695660696156, "min": 0.6827695660696156}, "EndTime": 1605107328.958239, "Dimensions": {"model": 29, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.958222}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6826936199171427, "sum": 0.6826936199171427, "min": 0.6826936199171427}, "EndTime": 1605107328.958351, "Dimensions": {"model": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107328.958336}

[11/11/2020 15:08:48 INFO 140525173397312] #quality_metric: host=algo-1, epoch=0, train binary_classification_cross_entropy_objective <loss>=0.228065397254
[2020-11-11 15:08:48.981] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 0, "duration": 14646, "num_examples": 1, "num_bytes": 164000}
[2020-11-11 15:08:50.596] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 2, "duration": 1615, "num_examples": 57, "num_bytes": 9325532}
#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.16336790322020553, "sum": 0.16336790322020553, "min": 0.16336790322020553}, "EndTime": 1605107331.510882, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107331.510801}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.15963867669444062, "sum": 0.15963867669444062, "min": 0.15963867669444062}, "EndTime": 1605107331.510974, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107331.510959}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.167725492760217, "sum": 0.167725492760217, "min": 0.167725492760217}, "EndTime": 1605107331.511049, "Dimensions": {"model": 2, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107331.511032}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.15992152579986313, "sum": 0.15992152579986313, "min": 0.15992152579986313}, "EndTime": 1605107331.511112, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107331.511099}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11252388389719829, "sum": 0.11252388389719829, "min": 0.11252388389719829}, "EndTime": 1605107331.511174, "Dimensions": {"model": 4, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107331.511157}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11211039655503723, "sum": 0.11211039655503723, "min": 0.11211039655503723}, "EndTime": 1605107331.511243, "Dimensions": {"mode1": 5, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107331.511225}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11214513959650346, "sum": 0.11214513959650346, "min": 0.11214513959650346}, "EndTime": 1605107331.511313, "Dimensions": {"mode1": 6, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 0}, "StartTime": 1605107331.511294}

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[11/11/2020 15:08:51 INFO 140525173397312] #quality_metric: host=algo-1, epoch=0, validation_binary_classification_cross_entropy_objective <loss>=0.16336790322
[11/11/2020 15:08:51 INFO 140525173397312] #early_stopping_criteria_metric: host=algo-1, epoch=0, criteria=sampled_accuracy, value=0.95870777131
[11/11/2020 15:08:51 INFO 140525173397312] Epoch 0: Loss improved. Updating b

```

```

est model
[11/11/2020 15:08:51 INFO 140525173397312] Saving model for epoch: 0
[11/11/2020 15:08:51 INFO 140525173397312] Saved checkpoint to "/tmp/tmpjAEj3
r/mx-mod-0000.params"
[11/11/2020 15:08:51 INFO 140525173397312] #progress_metric: host=algo-1, com
pleted 6 % of epochs
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[11/11/2020 15:08:51 INFO 140525173397312] #throughput_metric: host=algo-1, t
rain throughput=26898.671059 records/second
[2020-11-11 15:09:05.193] [tensorio] [info] epoch_stats={"data_pipeline": "/o
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[11/11/2020 15:09:05 INFO 140525173397312] #quality_metric: host=algo-1, epoch=1, train binary_classification_cross_entropy_objective <loss>=0.152064917829
[2020-11-11 15:09:06.729] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 5, "duration": 1517, "num_examples": 57, "num_bytes": 9325532}
#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14187073939445705, "sum": 0.14187073939445705, "min": 0.14187073939445705}}, "EndTime": 1605107347.467911, "Dimensions": {"mode

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[11/11/2020 15:09:07 INFO 140525173397312] #quality_metric: host=algo-1, epoch=1, validation_binary_classification_cross_entropy_objective <loss>=0.141870739394
[11/11/2020 15:09:07 INFO 140525173397312] #early_stopping_criteria_metric: host=algo-1, epoch=1, criteria=sampled_accuracy, value=0.959604663841
[11/11/2020 15:09:07 INFO 140525173397312] Epoch 1: Loss improved. Updating best model
[11/11/2020 15:09:07 INFO 140525173397312] Saving model for epoch: 1
[11/11/2020 15:09:07 INFO 140525173397312] Saved checkpoint to "/tmp/tmpjNc_Zf/mx-mod-0000.params"
[11/11/2020 15:09:07 INFO 140525173397312] #progress_metric: host=algo-1, completed 13 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Batches Since Last Reset": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Records Since Last Reset": {"count": 1, "max": 454904, "sum": 454904.0, "min": 454904}, "Total Batches Seen": {"count": 1, "max": 922, "sum": 922.0, "min": 922}, "Total Records Seen": {"count": 1, "max": 921808, "sum": 921808.0, "min": 921808}, "Max Records Seen Between Resets": {"count": 1, "max": 454904, "sum": 454904.0, "min": 454904}, "Reset Count": {"count": 1, "max": 4, "sum": 4.0, "min": 4}, "EndTime": 1605107347.476062, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 1}, "StartTime": 1605107331.523452}

[11/11/2020 15:09:07 INFO 140525173397312] #throughput_metric: host=algo-1, train throughput=28515.7015657 records/second
[2020-11-11 15:09:21.023] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 7, "duration": 13546, "num_examples": 455, "num_bytes": 74604256}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11212777358739912, "sum": 0.11212777358739912, "min": 0.11212777358739912}}, "EndTime": 1605107361.023494, "Dimensions": {"model": 5, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107361.023482}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40479683789492704, "sum": 0.40479683789492704, "min": 0.40479683789492704}}, "EndTime": 1605107361.02408, "Dimensions": {"model": 17, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107361.024068}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4047534291271596, "sum": 0.4047534291271596, "min": 0.4047534291271596}}, "EndTime": 1605107361.024126, "Dimensions": {"model": 18, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107361.024115}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40479787979462073, "sum": 0.40479787979462073, "min": 0.40479787979462073}}, "EndTime": 1605107361.024171, "Dimensions": {"model": 19, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107361.024151}
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"epoch": 2}, "StartTime": 1605107361.024159}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40516973345920376, "sum": 0.40516973345920376, "min": 0.40516973345920376}}, "EndTime": 1605107361.024223, "Dimensions": {"model": 20, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107361.02421}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4060079728181142, "sum": 0.4060079728181142, "min": 0.4060079728181142}}, "EndTime": 1605107361.024269, "Dimensions": {"model": 21, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107361.024257}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4051529577314066, "sum": 0.4051529577314066, "min": 0.4051529577314066}}, "EndTime": 1605107361.024313, "Dimensions": {"model": 22, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107361.024302}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4060009347520736, "sum": 0.4060009347520736, "min": 0.4060009347520736}}, "EndTime": 1605107361.024357, "Dimensions": {"model": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107361.024345}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6808175844705052, "sum": 0.6808175844705052, "min": 0.6808175844705052}}, "EndTime": 1605107361.024407, "Dimensions": {"model": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107361.024395}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6808784004917229, "sum": 0.6808784004917229, "min": 0.6808784004917229}}, "EndTime": 1605107361.024453, "Dimensions": {"model": 25, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107361.024442}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6808178942172013, "sum": 0.6808178942172013, "min": 0.6808178942172013}}, "EndTime": 1605107361.024497, "Dimensions": {"model": 26, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107361.024485}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6808787687192405, "sum": 0.6808787687192405, "min": 0.6808787687192405}}, "EndTime": 1605107361.024541, "Dimensions": {"model": 27, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107361.024529}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6813556787432028, "sum": 0.6813556787432028, "min": 0.6813556787432028}}, "EndTime": 1605107361.024584, "Dimensions": {"model": 28, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107361.024573}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6820349911593131, "sum": 0.6820349911593131, "min": 0.6820349911593131}, "EndTime": 1605107361.024628, "Dimensions": {"model": 29, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107361.024617}}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6813565433182905, "sum": 0.6813565433182905, "min": 0.6813565433182905}, "EndTime": 1605107361.024671, "Dimensions": {"model": 30, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107361.02466}}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6820339699631746, "sum": 0.6820339699631746, "min": 0.6820339699631746}, "EndTime": 1605107361.024722, "Dimensions": {"model": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107361.024706}}
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[11/11/2020 15:09:21 INFO 140525173397312] #quality_metric: host=algo-1, epoch=2, train binary_classification_cross_entropy_objective <loss>=0.138813492493
```

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[2020-11-11 15:09:22.458] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 8, "duration": 1416, "num_examples": 57, "num_bytes": 9325532}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.13409367100410882, "sum": 0.13409367100410882, "min": 0.13409367100410882}, "EndTime": 1605107363.195927, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.195843}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.12561349412758996, "sum": 0.12561349412758996, "min": 0.12561349412758996}, "EndTime": 1605107363.196016, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.196002}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.13611029951361475, "sum": 0.13611029951361475, "min": 0.13611029951361475}, "EndTime": 1605107363.196077, "Dimensions": {"model": 2, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.196059}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.12576215844076957, "sum": 0.12576215844076957, "min": 0.12576215844076957}, "EndTime": 1605107363.196151, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.196133}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10916272846273781, "sum": 0.10916272846273781, "min": 0.10916272846273781}, "EndTime": 1605107363.196219, "Dimensions": {"model": 4, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.196201}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10972590840852547, "sum": 0.10972590840852547, "min": 0.10972590840852547}, "EndTime": 1605107363.196261, "Dimensions": {"model": 5, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.196241}}
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n": 0.10972590840852547}], "EndTime": 1605107363.19629, "Dimensions": {"mode 1": 5, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.196271}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10897318665251693, "sum": 0.10897318665251693, "min": 0.10897318665251693}, "EndTime": 1605107363.19635, "Dimensions": {"mode 1": 6, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.196338}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10969606289549039, "sum": 0.10969606289549039, "min": 0.10969606289549039}, "EndTime": 1605107363.196402, "Dimensions": {"mode 1": 7, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.196391}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.15030377846548393, "sum": 0.15030377846548393, "min": 0.15030377846548393}, "EndTime": 1605107363.19646, "Dimensions": {"mode 1": 8, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.196443}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14515600487401945, "sum": 0.14515600487401945, "min": 0.14515600487401945}, "EndTime": 1605107363.196512, "Dimensions": {"mode 1": 9, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.196501}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1518584712400343, "sum": 0.1518584712400343, "min": 0.1518584712400343}, "EndTime": 1605107363.196561, "Dimensions": {"mode 1": 10, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.196546}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14518907519927968, "sum": 0.14518907519927968, "min": 0.14518907519927968}, "EndTime": 1605107363.196631, "Dimensions": {"mode 1": 11, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.196614}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14487241487352276, "sum": 0.14487241487352276, "min": 0.14487241487352276}, "EndTime": 1605107363.196768, "Dimensions": {"mode 1": 12, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.196682}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14696707323932803, "sum": 0.14696707323932803, "min": 0.14696707323932803}, "EndTime": 1605107363.196818, "Dimensions": {"mode 1": 13, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.196807}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14495073910211345, "sum": 0.14495073910211345, "min": 0.14495073910211345}, "EndTime": 1605107363.196853, "Dimensions": {"mode 1": 14, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.196807}}
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er", "epoch": 2}, "StartTime": 1605107363.196844}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1469855886392634, "sum": 0.1469855886392634, "min": 0.1469855886392634}}, "EndTime": 1605107363.196901, "Dimensions": {"mode1": 15, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.196891}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4025156215566224, "sum": 0.4025156215566224, "min": 0.4025156215566224}}, "EndTime": 1605107363.196956, "Dimensions": {"mode1": 16, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.19694}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40211302706261237, "sum": 0.40211302706261237, "min": 0.40211302706261237}}, "EndTime": 1605107363.19702, "Dimensions": {"mode1": 17, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.197003}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40270693724836726, "sum": 0.40270693724836726, "min": 0.40270693724836726}}, "EndTime": 1605107363.197087, "Dimensions": {"mode1": 18, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.19707}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4022868322990263, "sum": 0.4022868322990263, "min": 0.4022868322990263}}, "EndTime": 1605107363.197143, "Dimensions": {"mode1": 19, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.197131}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.3975361712220463, "sum": 0.3975361712220463, "min": 0.3975361712220463}}, "EndTime": 1605107363.197189, "Dimensions": {"mode1": 20, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.197179}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4088592081164034, "sum": 0.4088592081164034, "min": 0.4088592081164034}}, "EndTime": 1605107363.197226, "Dimensions": {"mode1": 21, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.197212}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.39675230906376674, "sum": 0.39675230906376674, "min": 0.39675230906376674}}, "EndTime": 1605107363.197285, "Dimensions": {"mode1": 22, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.197268}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40787516957990727, "sum": 0.40787516957990727, "min": 0.40787516957990727}}, "EndTime": 1605107363.19735, "Dimensions": {"mode1": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.197334}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6806617139619019, "sum": 0.6806617139619019, "min": 0.6806617139619019}, "EndTime": 1605107363.197401, "Dimensions": {"mode1": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.197385}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6810017882893973, "sum": 0.6810017882893973, "min": 0.6810017882893973}, "EndTime": 1605107363.197463, "Dimensions": {"mode1": 25, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.197447}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6806435009845484, "sum": 0.6806435009845484, "min": 0.6806435009845484}, "EndTime": 1605107363.197525, "Dimensions": {"mode1": 26, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.197508}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6810862014894213, "sum": 0.6810862014894213, "min": 0.6810862014894213}, "EndTime": 1605107363.197588, "Dimensions": {"mode1": 27, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.197571}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.682350974051668, "sum": 0.682350974051668, "min": 0.682350974051668}, "EndTime": 1605107363.197658, "Dimensions": {"model": 28, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.19764}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6774137501744874, "sum": 0.6774137501744874, "min": 0.6774137501744874}, "EndTime": 1605107363.197721, "Dimensions": {"mode1": 29, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.197704}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6826546385250377, "sum": 0.6826546385250377, "min": 0.6826546385250377}, "EndTime": 1605107363.197786, "Dimensions": {"mode1": 30, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.197769}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6796903433626243, "sum": 0.6796903433626243, "min": 0.6796903433626243}, "EndTime": 1605107363.197838, "Dimensions": {"mode1": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107363.197824}

[11/11/2020 15:09:23 INFO 140525173397312] #quality_metric: host=algo-1, epoch=2, validation_binary_classification_cross_entropy_objective <loss>=0.134093671004
[11/11/2020 15:09:23 INFO 140525173397312] #early_stopping_criteria_metric: host=algo-1, epoch=2, criteria=sampled_accuracy, value=0.959745352866
[11/11/2020 15:09:23 INFO 140525173397312] Epoch 2: Loss improved. Updating best model
[11/11/2020 15:09:23 INFO 140525173397312] Saving model for epoch: 2

```

```
[11/11/2020 15:09:23 INFO 140525173397312] Saved checkpoint to "/tmp/tmpCMZUwp/mx-mod-0000.params"
[11/11/2020 15:09:23 INFO 140525173397312] #progress_metric: host=algo-1, completed 20 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Batches Since Last Reset": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Records Since Last Reset": {"count": 1, "max": 454904, "sum": 454904.0, "min": 454904}, "Total Batches Seen": {"count": 1, "max": 1377, "sum": 1377.0, "min": 1377}, "Total Records Seen": {"count": 1, "max": 1376712, "sum": 1376712.0, "min": 1376712}, "Max Records Seen Between Resets": {"count": 1, "max": 454904, "sum": 454904.0, "min": 454904}, "Reset Count": {"count": 1, "max": 5, "sum": 5.0, "min": 5}, "EndTime": 1605107363.204468, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 2}, "StartTime": 1605107347.476341}

[11/11/2020 15:09:23 INFO 140525173397312] #throughput_metric: host=algo-1, train throughput=28922.7270676 records/second
[2020-11-11 15:09:37.338] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 9, "duration": 14133, "num_examples": 455, "num_bytes": 74604256}
#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1331697211748703, "sum": 0.1331697211748703, "min": 0.1331697211748703}, "EndTime": 1605107377.338484, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605107377.338362}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.12421756073871898, "sum": 0.12421756073871898, "min": 0.12421756073871898}, "EndTime": 1605107377.338596, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605107377.338566}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.12434022256456283, "sum": 0.12434022256456283, "min": 0.12434022256456283}, "EndTime": 1605107377.338702, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605107377.33869}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11040343772787355, "sum": 0.11040343772787355, "min": 0.11040343772787355}, "EndTime": 1605107377.338748, "Dimensions": {"model": 4, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605107377.338736}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.111900743744972, "sum": 0.111900743744972, "min": 0.111900743744972}, "EndTime": 1605107377.338794, "Dimensions": {"model": 5, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605107377.338782}
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[2020-11-11 15:09:38.677] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 11, "duration": 1321, "num_examples": 57, "num_bytes": 9325532}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6827846228098401, "sum": 0.6827846228098401, "min": 0.6827846228098401}}, "EndTime": 1605107379.429636, "Dimensions": {"mode1": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605107379.429619}

[11/11/2020 15:09:39 INFO 140525173397312] #quality_metric: host=algo-1, epoch=3, validation_binary_classification_cross_entropy_objective <loss>=0.130241814536
[11/11/2020 15:09:39 INFO 140525173397312] #early_stopping_criteria_metric: host=algo-1, epoch=3, criteria=sampled_accuracy, value=0.95979811125
[11/11/2020 15:09:39 INFO 140525173397312] Epoch 3: Loss improved. Updating best model
[11/11/2020 15:09:39 INFO 140525173397312] Saving model for epoch: 3
[11/11/2020 15:09:39 INFO 140525173397312] Saved checkpoint to "/tmp/tmpp60rSi/mx-mod-0000.params"
[11/11/2020 15:09:39 INFO 140525173397312] #progress_metric: host=algo-1, completed 26 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Batches Since Last Reset": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Records Since Last Reset": {"count": 1, "max": 454904, "sum": 454904.0, "min": 454904}, "Total Batches Seen": {"count": 1, "max": 1832, "sum": 1832.0, "min": 1832}, "Total Records Seen": {"count": 1, "max": 1831616, "sum": 1831616.0, "min": 1831616}, "Max Records Seen Between Resets": {"count": 1, "max": 454904, "sum": 454904.0, "min": 454904}, "Reset Count": {"count": 1, "max": 6, "sum": 6.0, "min": 6}}, "EndTime": 1605107379.436318, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 3}, "StartTime": 1605107363.204762}

[11/11/2020 15:09:39 INFO 140525173397312] #throughput_metric: host=algo-1, train throughput=28025.7227606 records/second
[2020-11-11 15:09:53.316] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 11, "duration": 13880, "num_examples": 455, "num_bytes": 74604256}
#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.13016311924468052, "sum": 0.13016311924468052, "min": 0.13016311924468052}}, "EndTime": 1605107393.317084, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107393.316981}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.12060312032489524, "sum": 0.12060312032489524, "min": 0.12060312032489524}}

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0.12060312032489524}}, "EndTime": 1605107393.317193, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107393.317171}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1318209312539794, "sum": 0.1318209312539794, "min": 0.1318209312539794}}, "EndTime": 1605107393.317271, "Dimensions": {"model": 2, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107393.317251}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.12069810687497849, "sum": 0.12069810687497849, "min": 0.12069810687497849}}, "EndTime": 1605107393.317342, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107393.317324}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1099877894397349, "sum": 0.1099877894397349, "min": 0.1099877894397349}}, "EndTime": 1605107393.317409, "Dimensions": {"model": 4, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107393.31739}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11178439030248163, "sum": 0.11178439030248163, "min": 0.11178439030248163}}, "EndTime": 1605107393.317474, "Dimensions": {"model": 5, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107393.317457}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10989117063614766, "sum": 0.10989117063614766, "min": 0.10989117063614766}}, "EndTime": 1605107393.317533, "Dimensions": {"model": 6, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107393.317517}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11177328971829183, "sum": 0.11177328971829183, "min": 0.11177328971829183}}, "EndTime": 1605107393.317593, "Dimensions": {"model": 7, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107393.317575}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14740351736598079, "sum": 0.14740351736598079, "min": 0.14740351736598079}}, "EndTime": 1605107393.318019, "Dimensions": {"model": 13, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107393.318002}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14739724370141385, "sum": 0.14739724370141385, "min": 0.14739724370141385}}, "EndTime": 1605107393.318132, "Dimensions": {"model": 15, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107393.318117}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40472085423406523, "sum": 0.40472085423406523, "min": 0.40472085423406523}}, "EndTime": 1605107393.318195, "Dimensions": {"model": 16, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107393.318178}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40479536713587555, "sum": 0.40479536713587555, "min": 0.40479536713587555}}, "EndTime": 1605107393.318261, "Dimensions": {"model": 17, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107393.318244}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4049035793758174, "sum": 0.4049035793758174, "min": 0.4049035793758174}}, "EndTime": 1605107393.318453, "Dimensions": {"model": 20, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107393.318436}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40594623091777515, "sum": 0.40594623091777515, "min": 0.40594623091777515}}, "EndTime": 1605107393.318628, "Dimensions": {"model": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107393.318613}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6807705551349119, "sum": 0.6807705551349119, "min": 0.6807705551349119}}, "EndTime": 1605107393.318686, "Dimensions": {"model": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107393.318669}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6810917425617773, "sum": 0.6810917425617773, "min": 0.6810917425617773}}, "EndTime": 1605107393.319053, "Dimensions": {"model": 30, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107393.319037}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6819833641556391, "sum": 0.6819833641556391, "min": 0.6819833641556391}}, "EndTime": 1605107393.319106, "Dimensions": {"model": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107393.319089}

[11/11/2020 15:09:53 INFO 140525173397312] #quality_metric: host=algo-1, epoch=4, train binary_classification_cross_entropy_objective <loss>=0.130163119245
[2020-11-11 15:09:54.585] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 14, "duration": 1250, "num_examples": 57, "num_bytes": 9325532}
#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.12804029419874852, "sum": 0.12804029419874852, "min": 0.12804029419874852}}, "EndTime": 1605107395.314448, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107395.314367}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11835050011818256, "sum": 0.11835050011818256, "min": 0.11835050011818256}}, "EndTime": 1605107395.314681, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107395.314663}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10850806300250128, "sum": 0.10850806300250128, "min": 0.10850806300250128}}, "EndTime": 1605107395.314747, "Dimensions": {"model": 4, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107395.31473}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10840219242385825, "sum": 0.10840219242385825, "min": 0.10840219242385825}}, "EndTime": 1605107395.314857, "Dimensions": {"mode1": 6, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107395.314839}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10922618702478813, "sum": 0.10922618702478813, "min": 0.10922618702478813}}, "EndTime": 1605107395.314903, "Dimensions": {"mode1": 7, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107395.314893}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14685856404378383, "sum": 0.14685856404378383, "min": 0.14685856404378383}}, "EndTime": 1605107395.314959, "Dimensions": {"mode1": 8, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107395.314948}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14423284934328176, "sum": 0.14423284934328176, "min": 0.14423284934328176}}, "EndTime": 1605107395.315016, "Dimensions": {"mode1": 9, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107395.31515}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14770827583458027, "sum": 0.14770827583458027, "min": 0.14770827583458027}}, "EndTime": 1605107395.315079, "Dimensions": {"mode1": 10, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107395.315062}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14668407211758552, "sum": 0.14668407211758552, "min": 0.14668407211758552}}, "EndTime": 1605107395.315261, "Dimensions": {"mode1": 13, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107395.315244}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40290549712824025, "sum": 0.40290549712824025, "min": 0.40290549712824025}}, "EndTime": 1605107395.315441, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107395.315423}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40293101493924405, "sum": 0.40293101493924405, "min": 0.40293101493924405}}, "EndTime": 1605107395.315572, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107395.31555}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4027644860921205, "sum": 0.4027644860921205, "min": 0.4027644860921205}}, "EndTime": 1605107395.315688, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 4}, "StartTime": 1605107395.315671}

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[11/11/2020 15:09:55 INFO 140525173397312] #quality_metric: host=algo-1, epoch=4, validation_binary_classification_cross_entropy_objective <loss>=0.128040294199
[11/11/2020 15:09:55 INFO 140525173397312] #early_stopping_criteria_metric: host=algo-1, epoch=4, criteria=sampled_accuracy, value=0.959903628018
[11/11/2020 15:09:55 INFO 140525173397312] Epoch 4: Loss improved. Updating best model
[11/11/2020 15:09:55 INFO 140525173397312] Saving model for epoch: 4
[11/11/2020 15:09:55 INFO 140525173397312] Saved checkpoint to "/tmp/tmp8st0VW/mx-mod-0000.params"

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[11/11/2020 15:09:55 INFO 140525173397312] #progress_metric: host=algo-1, completed 33 % of epochs
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[11/11/2020 15:09:55 INFO 140525173397312] #throughput_metric: host=algo-1, train throughput=28635.8398686 records/second
[2020-11-11 15:10:09.267] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 13, "duration": 13944, "num_examples": 455, "num_bytes": 74604256}
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[11/11/2020 15:10:09 INFO 140525173397312] #quality_metric: host=algo-1, epoch=5, train binary_classification_cross_entropy_objective <loss>=0.128366957509
[2020-11-11 15:10:10.732] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 17, "duration": 1445, "num_examples": 57, "num_bytes": 9325532}
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[11/11/2020 15:10:11 INFO 140525173397312] #quality_metric: host=algo-1, epoch=5, validation_binary_classification_cross_entropy_objective <loss>=0.126672173214
[11/11/2020 15:10:11 INFO 140525173397312] #early_stopping_criteria_metric: host=algo-1, epoch=5, criteria=sampled_accuracy, value=0.95997397253
[11/11/2020 15:10:11 INFO 140525173397312] Epoch 5: Loss improved. Updating best model
[11/11/2020 15:10:11 INFO 140525173397312] Saving model for epoch: 5
[11/11/2020 15:10:11 INFO 140525173397312] Saved checkpoint to "/tmp/tmpppTVdG6/mx-mod-0000.params"
[11/11/2020 15:10:11 INFO 140525173397312] #progress_metric: host=algo-1, completed 40 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Batches Since Last Reset": {"coun
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[11/11/2020 15:10:11 INFO 140525173397312] #throughput_metric: host=algo-1, train throughput=28135.8833316 records/second
[2020-11-11 15:10:25.609] [tensorio] [info] epoch_stats={"data_pipeline": "/o
pt/ml/input/data/train", "epoch": 15, "duration": 14118, "num_examples": 455,
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4058529730977466, "sum": 0.4058529730977466, "min": 0.4058529730977466}}, "EndTime": 1605107425.611473, "Dimensions": {"model": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107425.611457}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6807468334315632, "sum": 0.6807468334315632, "min": 0.6807468334315632}}, "EndTime": 1605107425.611518, "Dimensions": {"model": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107425.611508}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6819251722428242, "sum": 0.6819251722428242, "min": 0.6819251722428242}}, "EndTime": 1605107425.611926, "Dimensions": {"model": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107425.61191}

[11/11/2020 15:10:25 INFO 140525173397312] #quality_metric: host=algo-1, epoch=6, train binary_classification_cross_entropy_objective <loss>=0.127220902329
[2020-11-11 15:10:27.036] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 20, "duration": 1407, "num_examples": 57, "num_bytes": 9325532}
#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.12578004833312872, "sum": 0.12578004833312872, "min": 0.12578004833312872}}, "EndTime": 1605107427.812372, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.812274}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11480588661224574, "sum": 0.11480588661224574, "min": 0.11480588661224574}}, "EndTime": 1605107427.812466, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.812451}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1270476124677971, "sum": 0.1270476124677971, "min": 0.1270476124677971}}, "EndTime": 1605107427.81253, "Dimensions": {"model": 2, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.812513}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11484753559546526, "sum": 0.11484753559546526, "min": 0.11484753559546526}}, "EndTime": 1605107427.812593, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.812575}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10828410096746546, "sum": 0.10828410096746546, "min": 0.10828410096746546}}, "EndTime": 1605107427.812664, "Dimensions": {"model": 4, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.812647}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10890442200978977, "sum": 0.10890442200978977, "min": 0.10890442200978977}}, "EndTime": 1605107427.81273, "Dimensions": {"model": 5, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.812713}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10820247196043012, "sum": 0.10820247196043012, "min": 0.10820247196043012}, "EndTime": 1605107427.812784, "Dimensions": {"mode1": 6, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.812767}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10889898323349027, "sum": 0.10889898323349027, "min": 0.10889898323349027}, "EndTime": 1605107427.812848, "Dimensions": {"mode1": 7, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.812832}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14419540542933407, "sum": 0.14419540542933407, "min": 0.14419540542933407}, "EndTime": 1605107427.812975, "Dimensions": {"mode1": 9, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.812959}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14645763126391606, "sum": 0.14645763126391606, "min": 0.14645763126391606}, "EndTime": 1605107427.813037, "Dimensions": {"mode1": 10, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.81302}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14418816593720873, "sum": 0.14418816593720873, "min": 0.14418816593720873}, "EndTime": 1605107427.813096, "Dimensions": {"mode1": 11, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.81308}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14692269775686875, "sum": 0.14692269775686875, "min": 0.14692269775686875}, "EndTime": 1605107427.81322, "Dimensions": {"mode1": 13, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.813209}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14436635294677214, "sum": 0.14436635294677214, "min": 0.14436635294677214}, "EndTime": 1605107427.813271, "Dimensions": {"mode1": 14, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.813255}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14693194888243247, "sum": 0.14693194888243247, "mi
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40283040079781945, "sum": 0.40283040079781945, "min": 0.40283040079781945}}, "EndTime": 1605107427.813394, "Dimensions": {"mode 1": 16, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.813378}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40287507078674156, "sum": 0.40287507078674156, "min": 0.40287507078674156}}, "EndTime": 1605107427.813516, "Dimensions": {"mode 1": 18, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.813498}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4014630755841823, "sum": 0.4014630755841823, "min": 0.4014630755841823}}, "EndTime": 1605107427.813583, "Dimensions": {"mode 1": 19, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.813565}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40076434524853044, "sum": 0.40076434524853044, "min": 0.40076434524853044}}, "EndTime": 1605107427.813762, "Dimensions": {"mode 1": 22, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.813746}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4280762295150804, "sum": 0.4280762295150804, "min": 0.4280762295150804}}, "EndTime": 1605107427.813823, "Dimensions": {"mode 1": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.813806}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6805752559880766, "sum": 0.6805752559880766, "min": 0.6805752559880766}}, "EndTime": 1605107427.813886, "Dimensions": {"mode 1": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.813806}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6816528904226908, "sum": 0.6816528904226908, "min": 0.6816528904226908}}, "EndTime": 1605107427.814092, "Dimensions": {"mode1": 27, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.814075}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6809118472231916, "sum": 0.6809118472231916, "min": 0.6809118472231916}}, "EndTime": 1605107427.814152, "Dimensions": {"mode1": 28, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.814136}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.685482608993807, "sum": 0.685482608993807, "min": 0.685482608993807}}, "EndTime": 1605107427.814339, "Dimensions": {"model": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107427.814321}

[11/11/2020 15:10:27 INFO 140525173397312] #quality_metric: host=algo-1, epoch=6, validation_binary_classification_cross_entropy_objective <loss>=0.125780048333
[11/11/2020 15:10:27 INFO 140525173397312] #early_stopping_criteria_metric: host=algo-1, epoch=6, criteria=sampled_accuracy, value=0.95997397253
[11/11/2020 15:10:27 INFO 140525173397312] Epoch 6: Loss improved. Updating best model
[11/11/2020 15:10:27 INFO 140525173397312] Saving model for epoch: 6
[11/11/2020 15:10:27 INFO 140525173397312] Saved checkpoint to "/tmp/tmps6kRD6/mx-mod-0000.params"
[11/11/2020 15:10:27 INFO 140525173397312] #progress_metric: host=algo-1, completed 46 % of epochs

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#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Batches Since Last Reset": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Records Since Last Reset": {"count": 1, "max": 454904, "sum": 454904.0, "min": 454904}, "Total Batches Seen": {"count": 1, "max": 3197, "sum": 3197.0, "min": 3197}, "Total Records Seen": {"count": 1, "max": 3196328, "sum": 3196328.0, "min": 3196328}, "Max Records Seen Between Resets": {"count": 1, "max": 454904, "sum": 454904.0, "min": 454904}, "Reset Count": {"count": 1, "max": 9, "sum": 9.0, "min": 9}}, "EndTime": 1605107427.821158, "Dimensions": {"Host": "algo-1", "Meta": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 6}, "StartTime": 1605107411.49083}

[11/11/2020 15:10:27 INFO 140525173397312] #throughput_metric: host=algo-1, train throughput=27856.1761692 records/second
[2020-11-11 15:10:41.938] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 17, "duration": 14116, "num_examples": 455, "num_bytes": 74604256}
#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1264613309851827, "sum": 0.1264613309851827, "min": 0.1264613309851827}, "EndTime": 1605107441.938748, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 7}, "StartTime": 1605107441.938632}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11520569847543859, "sum": 0.11520569847543859, "min": 0.11520569847543859}, "EndTime": 1605107441.938847, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 7}, "StartTime": 1605107441.938826}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1277553316864148, "sum": 0.1277553316864148, "min": 0.1277553316864148}, "EndTime": 1605107441.938912, "Dimensions": {"model": 2, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 7}, "StartTime": 1605107441.938896}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11523722059611181, "sum": 0.11523722059611181, "min": 0.11523722059611181}, "EndTime": 1605107441.938986, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 7}, "StartTime": 1605107441.938968}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11154222634605374, "sum": 0.11154222634605374, "min": 0.11154222634605374}, "EndTime": 1605107441.939124, "Dimensions": {"model": 5, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 7}, "StartTime": 1605107441.939107}

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"Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 7}, "StartTime": 1605107441.939172}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11153696784469, "sum": 0.11153696784469, "min": 0.11153696784469}}, "EndTime": 1605107441.939252, "Dimensions": {"model": 7, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 7}, "StartTime": 1605107441.939234}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1468654219841642, "sum": 0.1468654219841642, "min": 0.1468654219841642}}, "EndTime": 1605107441.939327, "Dimensions": {"model": 8, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 7}, "StartTime": 1605107441.939307}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1454493280822485, "sum": 0.1454493280822485, "min": 0.1454493280822485}}, "EndTime": 1605107441.93962, "Dimensions": {"model": 12, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 7}, "StartTime": 1605107441.939601}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14714318251084652, "sum": 0.14714318251084652, "min": 0.14714318251084652}}, "EndTime": 1605107441.93982, "Dimensions": {"model": 15, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 7}, "StartTime": 1605107441.939803}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40478643422399846, "sum": 0.40478643422399846, "min": 0.40478643422399846}}, "EndTime": 1605107441.939999, "Dimensions": {"model": 19, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 7}, "StartTime": 1605107441.939992}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40476380517094146, "sum": 0.40476380517094146, "min": 0.40476380517094146}}, "EndTime": 1605107441.940179, "Dimensions": {"model": 22, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 7}, "StartTime": 1605107441.94016}

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[11/11/2020 15:10:41 INFO 140525173397312] #quality_metric: host=algo-1, epoch=5, train binary_classification_cross_entropy_objective <loss>=0.126461330985
[2020-11-11 15:10:43.271] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 23, "duration": 1313, "num_examples": 57, "num_bytes": 9325532}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti  
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti  
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[11/11/2020 15:10:44 INFO 140525173397312] #quality_metric: host=algo-1, epoch=7, validation_binary_classification_cross_entropy_objective <loss>=0.12518323066
[11/11/2020 15:10:44 INFO 140525173397312] #early_stopping_criteria_metric: host=algo-1, epoch=7, criteria=sampled_accuracy, value=0.95997397253
[11/11/2020 15:10:44 INFO 140525173397312] Epoch 7: Loss improved. Updating best model
[11/11/2020 15:10:44 INFO 140525173397312] Saving model for epoch: 7
[11/11/2020 15:10:44 INFO 140525173397312] Saved checkpoint to "/tmp/tmpjZR8VH/mx-mod-0000.params"
[11/11/2020 15:10:44 INFO 140525173397312] #progress_metric: host=algo-1, completed 53 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Batches Since Last Reset": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Records Since Last Reset": {"count": 1, "max": 454904, "sum": 454904.0, "min": 454904}, "Total Batches Seen": {"count": 1, "max": 3652, "sum": 3652.0, "min": 3652}, "Total Records Seen": {"count": 1, "max": 3651232, "sum": 3651232.0, "min": 3651232}, "Max Records Seen Between Resets": {"count": 1, "max": 454904, "sum": 454904.0, "min": 454904}, "Reset Count": {"count": 1, "max": 10, "sum": 10.0, "min": 10}}, "EndTime": 1605107444.073581, "Dimensions": {"Host": "algo-1", "Metric": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 7}, "StartTime": 1605107427.82146}

[11/11/2020 15:10:44 INFO 140525173397312] #throughput_metric: host=algo-1, train throughput=27990.2307756 records/second
[2020-11-11 15:10:58.221] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 19, "duration": 14147, "num_examples": 455, "num_bytes": 74604256}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6818762029572205, "sum": 0.6818762029572205, "min": 0.6818762029572205}}, "EndTime": 1605107458.223813, "Dimensions": {"model": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 8}, "StartTime": 1605107458.223796}

[11/11/2020 15:10:58 INFO 140525173397312] #quality_metric: host=algo-1, epoch=8, train binary_classification_cross_entropy_objective <loss>=0.125948764078
[2020-11-11 15:10:59.611] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 26, "duration": 1367, "num_examples": 57, "num_bytes": 9325532}
#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.12477877077026485, "sum": 0.12477877077026485, "min": 0.12477877077026485}}, "EndTime": 1605107460.350242, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 8}, "StartTime": 1605107460.350156}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.12592455064609098, "sum": 0.12592455064609098, "min": 0.12592455064609098}}, "EndTime": 1605107460.350402, "Dimensions": {"model": 2, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 8}, "StartTime": 1605107460.350384}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4012357847540017, "sum": 0.4012357847540017, "min": 0.4012357847540017}}, "EndTime": 1605107460.351404, "Dimensions": {"mode1": 19, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 8}, "StartTime": 1605107460.351389}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4014290786704791, "sum": 0.4014290786704791, "min": 0.4014290786704791}}, "EndTime": 1605107460.351594, "Dimensions": {"mode1": 22, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 8}, "StartTime": 1605107460.351578}

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[11/11/2020 15:11:00 INFO 140525173397312] #quality_metric: host=algo-1, epoch=8, validation_binary_classification_cross_entropy_objective <loss>=0.12477877077
[11/11/2020 15:11:00 INFO 140525173397312] #early_stopping_criteria_metric: host=algo-1, epoch=8, criteria=sampled_accuracy, value=0.95997397253
[11/11/2020 15:11:00 INFO 140525173397312] Epoch 8: Loss improved. Updating best model
[11/11/2020 15:11:00 INFO 140525173397312] Saving model for epoch: 8
[11/11/2020 15:11:00 INFO 140525173397312] Saved checkpoint to "/tmp/tmpDAwc6X/mx-mod-0000.params"
[11/11/2020 15:11:00 INFO 140525173397312] #progress_metric: host=algo-1, completed 60 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Batches Since Last Reset": {"count": 1, "max": 455, "sum": 455.0, "min": 455}}}

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[11/11/2020 15:11:00 INFO 140525173397312] #throughput_metric: host=algo-1, train throughput=27933.7758728 records/second
[2020-11-11 15:11:14.423] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 21, "duration": 14064, "num_examples": 455, "num_bytes": 74604256}
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[11/11/2020 15:11:14 INFO 140525173397312] #quality_metric: host=algo-1, epoch=9, train binary_classification_cross_entropy_objective <loss>=0.125599744923
[2020-11-11 15:11:15.869] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 29, "duration": 1427, "num_examples": 57, "num_bytes": 9325532}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4206505690537866, "sum": 0.4206505690537866, "min": 0.4206505690537866}}, "EndTime": 1605107476.638984, "Dimensions": {"mode 1": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605107476.638966}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6806384196411496, "sum": 0.6806384196411496, "min": 0.6806384196411496}}, "EndTime": 1605107476.639045, "Dimensions": {"mode 1": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605107476.639028}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6814854014442471, "sum": 0.6814854014442471, "min": 0.6814854014442471}}, "EndTime": 1605107476.639105, "Dimensions": {"mode 1": 25, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605107476.639089}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6805701746446777, "sum": 0.6805701746446777, "min": 0.6805701746446777}}, "EndTime": 1605107476.639164, "Dimensions": {"mode 1": 26, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605107476.639148}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6820120482322919, "sum": 0.6820120482322919, "min": 0.6820120482322919}}, "EndTime": 1605107476.639223, "Dimensions": {"mode 1": 27, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605107476.639206}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6806625737329333, "sum": 0.6806625737329333, "min": 0.6806625737329333}}, "EndTime": 1605107476.639285, "Dimensions": {"mode 1": 28, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605107476.639269}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6774314897947561, "sum": 0.6774314897947561, "min": 0.6774314897947561}}, "EndTime": 1605107476.639355, "Dimensions": {"mode 1": 29, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605107476.639336}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6774317699448675, "sum": 0.6774317699448675, "min": 0.6774317699448675}}, "EndTime": 1605107476.63949, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605107476.639472}

[11/11/2020 15:11:16 INFO 140525173397312] #quality_metric: host=algo-1, epoch=9, validation_binary_classification_cross_entropy_objective <loss>=0.124503274532
[11/11/2020 15:11:16 INFO 140525173397312] #early_stopping_criteria_metric: host=algo-1, epoch=9, criteria=sampled_accuracy, value=0.960044317043
[11/11/2020 15:11:16 INFO 140525173397312] Epoch 9: Loss improved. Updating best model
[11/11/2020 15:11:16 INFO 140525173397312] Saving model for epoch: 9
[11/11/2020 15:11:16 INFO 140525173397312] Saved checkpoint to "/tmp/tmpnu1G6h/mx-mod-0000.params"
[11/11/2020 15:11:16 INFO 140525173397312] #progress_metric: host=algo-1, completed 66 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Batches Since Last Reset": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Records Since Last Reset": {"count": 1, "max": 454904, "sum": 454904.0, "min": 454904}, "Total Batches Seen": {"count": 1, "max": 4562, "sum": 4562.0, "min": 4562}, "Total Records Seen": {"count": 1, "max": 4561040, "sum": 4561040.0, "min": 4561040}, "Max Records Seen Between Resets": {"count": 1, "max": 454904, "sum": 454904.0, "min": 454904}, "Reset Count": {"count": 1, "max": 12, "sum": 12.0, "min": 12}, "EndTime": 1605107476.645743, "Dimensions": {"Host": "algo-1", "Metric": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 9}, "StartTime": 1605107460.35911}

[11/11/2020 15:11:16 INFO 140525173397312] #throughput_metric: host=algo-1, train throughput=27930.913454 records/second
[2020-11-11 15:11:30.394] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 23, "duration": 13748, "num_examples": 455, "num_bytes": 74604256}
#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.12536408554614903, "sum": 0.12536408554614903, "min": 0.12536408554614903}}, "EndTime": 1605107490.39519, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.394923}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.12624488028975836, "sum": 0.12624488028975836, "min": 0.12624488028975836}}

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0.12624488028975836}}, "EndTime": 1605107490.39538, "Dimensions": {"model": 2, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.39536}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11265299497091823, "sum": 0.11265299497091823, "min": 0.11265299497091823}}, "EndTime": 1605107490.395441, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.395424}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10934257446826817, "sum": 0.10934257446826817, "min": 0.10934257446826817}}, "EndTime": 1605107490.395497, "Dimensions": {"model": 4, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.39548}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10928037910629475, "sum": 0.10928037910629475, "min": 0.10928037910629475}}, "EndTime": 1605107490.395615, "Dimensions": {"model": 6, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.395599}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11123129309431572, "sum": 0.11123129309431572, "min": 0.11123129309431572}}, "EndTime": 1605107490.395674, "Dimensions": {"model": 7, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.395658}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14642922392185564, "sum": 0.14642922392185564, "min": 0.14642922392185564}}, "EndTime": 1605107490.395731, "Dimensions": {"model": 8, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.395715}

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"epoch": 10}, "StartTime": 1605107490.395894}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14538065825474944, "sum": 0.14538065825474944, "min": 0.14538065825474944}}, "EndTime": 1605107490.395974, "Dimensions": {"model": 12, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.395956}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1469336243516023, "sum": 0.1469336243516023, "min": 0.1469336243516023}}, "EndTime": 1605107490.396026, "Dimensions": {"model": 13, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.396009}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14538085112382662, "sum": 0.14538085112382662, "min": 0.14538085112382662}}, "EndTime": 1605107490.396077, "Dimensions": {"model": 14, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.396061}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1469335452848594, "sum": 0.1469335452848594, "min": 0.1469335452848594}}, "EndTime": 1605107490.396137, "Dimensions": {"model": 15, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.39612}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4046910822528049, "sum": 0.4046910822528049, "min": 0.4046910822528049}}, "EndTime": 1605107490.396195, "Dimensions": {"model": 16, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.39618}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4047785612265969, "sum": 0.4047785612265969, "min": 0.4047785612265969}}, "EndTime": 1605107490.39625, "Dimensions": {"model": 17, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.396236}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4047058232513293, "sum": 0.4047058232513293, "min": 0.4047058232513293}}, "EndTime": 1605107490.396306, "Dimensions": {"model": 18, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.396292}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4047256624331033, "sum": 0.4047256624331033, "min": 0.4047256624331033}}, "EndTime": 1605107490.396418, "Dimensions": {"model": 20, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.3964}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4055985055662987, "sum": 0.4055985055662987, "min": 0.4055985055662987}}, "EndTime": 1605107490.396476, "Dimensions": {"model": 21, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.396459}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40472568817810867, "sum": 0.40472568817810867, "min": 0.40472568817810867}}, "EndTime": 1605107490.396527, "Dimensions": {"model": 22, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.396511}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40559851867406904, "sum": 0.40559851867406904, "min": 0.40559851867406904}}, "EndTime": 1605107490.396583, "Dimensions": {"model": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.396567}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6807348004983911, "sum": 0.6807348004983911, "min": 0.6807348004983911}}, "EndTime": 1605107490.396634, "Dimensions": {"model": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.396619}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6808554346025778, "sum": 0.6808554346025778, "min": 0.6808554346025778}}, "EndTime": 1605107490.396694, "Dimensions": {"model": 25, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.396677}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6807378862691871, "sum": 0.6807378862691871, "min": 0.6807378862691871}}, "EndTime": 1605107490.396753, "Dimensions": {"model": 26, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.396736}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6808574229505093, "sum": 0.6808574229505093, "min": 0.6808574229505093}}, "EndTime": 1605107490.39681, "Dimensions": {"model": 27, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.396794}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6807816913621542, "sum": 0.6807816913621542, "min": 0.6807816913621542}}, "EndTime": 1605107490.39687, "Dimensions": {"model": 28, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.396853}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6818229643027688, "sum": 0.6818229643027688, "min": 0.6818229643027688}}, "EndTime": 1605107490.396926, "Dimensions": {"model": 29, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107490.396911}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6807819853795257, "sum": 0.6807819853795257, "min": 0.6807819853795257}}
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[11/11/2020 15:11:30 INFO 140525173397312] #quality_metric: host=algo-1, epoch=10, train binary_classification_cross_entropy_objective <loss>=0.125364085546
[2020-11-11 15:11:31.770] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 32, "duration": 1357, "num_examples": 57, "num_bytes": 9325532}
#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.12431648216423995, "sum": 0.12431648216423995, "min": 0.12431648216423995}}, "EndTime": 1605107492.541503, "Dimensions": {"model": 0, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107492.541419}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11136021332398395, "sum": 0.11136021332398395, "min": 0.11136021332398395}}, "EndTime": 1605107492.541721, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107492.541703}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10821965825739469, "sum": 0.10821965825739469, "min": 0.10821965825739469}}, "EndTime": 1605107492.541788, "Dimensions": {"model": 4, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107492.541771}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10880257764979671, "sum": 0.10880257764979671, "min": 0.10880257764979671}}, "EndTime": 1605107492.541992, "Dimensions": {"model": 7, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107492.541975}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1453145277071852, "sum": 0.1453145277071852, "min": 0.1453145277071852}}, "EndTime": 1605107492.542053, "Dimensions": {"model": 8, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107492.542036}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14424890631865286, "sum": 0.14424890631865286, "min": 0.14424890631865286}}, "EndTime": 1605107492.542114, "Dimensions": {"model": 9, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 10}, "StartTime": 1605107492.542097}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti
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[11/11/2020 15:11:32 INFO 140525173397312] #quality_metric: host=algo-1, epoch=10, validation_binary_classification_cross_entropy_objective <loss>=0.124316482164
[11/11/2020 15:11:32 INFO 140525173397312] #early_stopping_criteria_metric: host=algo-1, epoch=10, criteria=sampled_accuracy, value=0.960009144787
[11/11/2020 15:11:32 INFO 140525173397312] Epoch 10: Loss improved. Updating best model
[11/11/2020 15:11:32 INFO 140525173397312] Saving model for epoch: 10
[11/11/2020 15:11:32 INFO 140525173397312] Saved checkpoint to "/tmp/tmpcrb5xk/mx-mod-0000.params"
[11/11/2020 15:11:32 INFO 140525173397312] #progress_metric: host=algo-1, completed 73 % of epochs
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[11/11/2020 15:11:32 INFO 140525173397312] #throughput_metric: host=algo-1, train throughput=28602.6928488 records/second
[2020-11-11 15:11:46.568] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 25, "duration": 14017, "num_examples": 455, "num_bytes": 74604256}
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[11/11/2020 15:11:46 INFO 140525173397312] #quality_metric: host=algo-1, epoch=11, train binary_classification_cross_entropy_objective <loss>=0.125204656122
[2020-11-11 15:11:48.002] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 35, "duration": 1410, "num_examples": 57, "num_bytes": 9325532}
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[11/11/2020 15:11:48 INFO 140525173397312] #quality_metric: host=algo-1, epoc
h=11, validation_binary_classification_cross_entropy_objective <loss>=0.12419
1230511
[11/11/2020 15:11:48 INFO 140525173397312] #early_stopping_criteria_metric: h
ost=algo-1, epoch=11, criteria=sampled_accuracy, value=0.959938800274
[11/11/2020 15:11:48 INFO 140525173397312] Epoch 11: Loss improved. Updating
best model
[11/11/2020 15:11:48 INFO 140525173397312] Saving model for epoch: 11
[11/11/2020 15:11:48 INFO 140525173397312] Saved checkpoint to "/tmp/tmpAi7cw
d/mx-mod-0000.params"
[11/11/2020 15:11:48 INFO 140525173397312] #progress_metric: host=algo-1, com
pleted 80 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max":
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[11/11/2020 15:11:48 INFO 140525173397312] #throughput_metric: host=algo-1, t
rain throughput=28062.6032876 records/second
[2020-11-11 15:12:02.483] [tensorio] [info] epoch_stats={"data_pipeline": "/o
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.680851187550549, "sum": 0.680851187550549, "min": 0.680851187550549}}, "EndTime": 1605107522.485345, "Dimensions": {"model": 27, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 12}, "StartTime": 1605107522.485334}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6807514073039992, "sum": 0.6807514073039992, "min": 0.6807514073039992}}, "EndTime": 1605107522.485404, "Dimensions": {"model": 28, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 12}, "StartTime": 1605107522.485388}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6818149820067284, "sum": 0.6818149820067284, "min": 0.6818149820067284}}, "EndTime": 1605107522.485455, "Dimensions": {"model": 29, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 12}, "StartTime": 1605107522.485442}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6807516558811003, "sum": 0.6807516558811003, "min": 0.6807516558811003}}, "EndTime": 1605107522.485502, "Dimensions": {"model": 30, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 12}, "StartTime": 1605107522.485491}
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[11/11/2020 15:12:02 INFO 140525173397312] #quality_metric: host=algo-1, epoch=12, train binary_classification_cross_entropy_objective <loss>=0.125098373514
[2020-11-11 15:12:04.030] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 38, "duration": 1525, "num_examples": 57, "num_bytes": 9325532}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4034299805348697, "sum": 0.4034299805348697, "mi
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40274827495368526, "sum": 0.40274827495368526, "min": 0.40274827495368526}}, "EndTime": 1605107524.772743, "Dimensions": {"mode 1": 22, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 12}, "StartTime": 1605107524.772732}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4116788932261326, "sum": 0.4116788932261326, "min": 0.4116788932261326}}, "EndTime": 1605107524.772795, "Dimensions": {"mode 1": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 12}, "StartTime": 1605107524.772785}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.680648028467957, "sum": 0.680648028467957, "min": 0.680648028467957}}, "EndTime": 1605107524.772834, "Dimensions": {"model": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 12}, "StartTime": 1605107524.772824}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.681885316264874, "sum": 0.681885316264874, "min": 0.681885316264874}}, "EndTime": 1605107524.772872, "Dimensions": {"model": 25, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner",
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6820276947770162, "sum": 0.6820276947770162, "min": 0.6820276947770162}}, "EndTime": 1605107524.77298, "Dimensions": {"mode1": 27, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 12}, "StartTime": 1605107524.77297}

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[11/11/2020 15:12:04 INFO 140525173397312] #quality_metric: host=algo-1, epoch=12, validation binary_classification_cross_entropy_objective <loss>=0.124108229332
[11/11/2020 15:12:04 INFO 140525173397312] #early_stopping_criteria_metric: host=algo-1, epoch=12, criteria=sampled_accuracy, value=0.959903628018
[11/11/2020 15:12:04 INFO 140525173397312] Epoch 12: Loss improved. Updating best model
[11/11/2020 15:12:04 INFO 140525173397312] Saving model for epoch: 12
[11/11/2020 15:12:04 INFO 140525173397312] Saved checkpoint to "/tmp/tmpXgNnz1/mx-mod-0000.params"
[11/11/2020 15:12:04 INFO 140525173397312] #progress_metric: host=algo-1, completed 86 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Batches Since Last Reset": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Records Since Last Reset": {"count": 1, "max": 454904, "sum": 454904.0, "min": 454904}, "Total Batches Seen": {"count": 1, "max": 5927, "sum": 5927.0, "min": 5927}, "Total Records Seen": {"count": 1, "max": 5925752, "sum": 5925752.0, "min": 5925752}, "Time Since Last Reset": {"count": 1, "max": 1000000000.0, "sum": 1000000000.0, "min": 1000000000.0}}}
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[11/11/2020 15:12:04 INFO 140525173397312] #throughput_metric: host=algo-1, train throughput=28397.6592006 records/second
[2020-11-11 15:12:18.954] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 29, "duration": 14173, "num_examples": 455, "num_bytes": 74604256}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.12477605720553629, "sum": 0.12477605720553629, "min": 0.12477605720553629}}, "EndTime": 1605107538.954623, "Dimensions": {"model": 2, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107538.954604}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.11140205126186825, "sum": 0.11140205126186825, "min": 0.11140205126186825}}, "EndTime": 1605107538.954692, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107538.954674}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40551224601846436, "sum": 0.40551224601846436, "min": 0.40551224601846436}}, "EndTime": 1605107538.955967, "Dimensions": {"model": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107538.95595}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6807434034977715, "sum": 0.6807434034977715, "min": 0.6807434034977715}}, "EndTime": 1605107538.956336, "Dimensions": {"model": 30, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107538.95632}

#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6818632052921514, "sum": 0.6818632052921514, "min": 0.6818632052921514}}, "EndTime": 1605107538.956395, "Dimensions": {"model": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107538.956379}

[11/11/2020 15:12:18 INFO 140525173397312] #quality_metric: host=algo-1, epoch=13, train binary_classification_cross_entropy_objective <loss>=0.1250278463
83
[2020-11-11 15:12:20.273] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 41, "duration": 1299, "num_examples": 57, "num_bytes": 9325532}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti  
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti  
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objecti  
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[11/11/2020 15:12:21 INFO 140525173397312] #quality_metric: host=algo-1, epoch=13, validation binary_classification_cross_entropy_objective <loss>=0.124052303293
[11/11/2020 15:12:21 INFO 140525173397312] #early_stopping_criteria_metric: host=algo-1, epoch=13, criteria=sampled_accuracy, value=0.959868455762
[11/11/2020 15:12:21 INFO 140525173397312] Epoch 13: Loss improved. Updating best model
[11/11/2020 15:12:21 INFO 140525173397312] Saving model for epoch: 13
[11/11/2020 15:12:21 INFO 140525173397312] Saved checkpoint to "/tmp/tmpigz6mD/mx-mod-0000.params"
[11/11/2020 15:12:21 INFO 140525173397312] #progress_metric: host=algo-1, completed 93 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Batches Since Last Reset": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Records Since Last Reset": {"count": 1, "max": 454904, "sum": 454904.0, "min": 454904}, "Total Batches Seen": {"count": 1, "max": 6382, "sum": 6382.0, "min": 6382}, "Total Records Seen": {"count": 1, "max": 6380656, "sum": 6380656.0, "min": 6380656}, "Max Records Seen Between Resets": {"count": 1, "max": 454904, "sum": 454904.0, "min": 454904}, "Reset Count": {"count": 1, "max": 16, "sum": 16.0, "min": 16}, "EndTime": 1605107541.018981, "Dimensions": {"Host": "algo-1", "Model": "training_data_iter", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 13}, "StartTime": 1605107524.780139}

[11/11/2020 15:12:21 INFO 140525173397312] #throughput_metric: host=algo-1, train throughput=28013.1013247 records/second
[2020-11-11 15:12:35.199] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/train", "epoch": 31, "duration": 14180, "num_examples": 455, "num_bytes": 74604256}
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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.14599326633671833, "sum": 0.14599326633671833, "min": 0.14599326633671833}}, "EndTime": 1605107555.200373, "Dimensions": {"model": 10, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107555.200356}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6807329902816974, "sum": 0.6807329902816974, "min": 0.6807329902816974}}, "EndTime": 1605107555.201274, "Dimensions": {"model": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107555.201257}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6807408773951593, "sum": 0.6807408773951593, "min": 0.6807408773951593}}, "EndTime": 1605107555.201521, "Dimensions": {"model": 28, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107555.201504}

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#metrics {"Metrics": {"train_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6807407968663959, "sum": 0.6807407968663959, "min": 0.6807407968663959}}, "EndTime": 1605107555.201655, "Dimensions": {"model": 30, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107555.201639}
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[11/11/2020 15:12:35 INFO 140525173397312] #quality_metric: host=algo-1, epoch=14, train binary_classification_cross_entropy_objective <loss>=0.124974089165
[2020-11-11 15:12:36.657] [tensorio] [info] epoch_stats={"data_pipeline": "/opt/ml/input/data/validation", "epoch": 44, "duration": 1436, "num_examples": 57, "num_bytes": 9325532}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.1099527221248192, "sum": 0.1099527221248192, "min": 0.1099527221248192}}, "EndTime": 1605107557.389562, "Dimensions": {"model": 1, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107557.389547}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10995181740633223, "sum": 0.10995181740633223, "min": 0.10995181740633223}}, "EndTime": 1605107557.389678, "Dimensions": {"model": 3, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107557.389669}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10817119550824872, "sum": 0.10817119550824872, "min": 0.10817119550824872}}, "EndTime": 1605107557.3898, "Dimensions": {"model": 6, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107557.389785}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.10885183885359431, "sum": 0.10885183885359431, "min": 0.10885183885359431}}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40341167310077375, "sum": 0.40341167310077375, "min": 0.40341167310077375}}, "EndTime": 1605107557.390437, "Dimensions": {"mode 1": 16, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107557.390411}
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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40186750232432283, "sum": 0.40186750232432283, "min": 0.40186750232432283}}, "EndTime": 1605107557.390624, "Dimensions": {"mode1": 19, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107557.390607}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40301227940228873, "sum": 0.40301227940228873, "min": 0.40301227940228873}}, "EndTime": 1605107557.390687, "Dimensions": {"mode1": 20, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107557.390669}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.40301203789357204, "sum": 0.40301203789357204, "min": 0.40301203789357204}}, "EndTime": 1605107557.390822, "Dimensions": {"mode1": 22, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107557.390804}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.4072859376863374, "sum": 0.4072859376863374, "min": 0.4072859376863374}}, "EndTime": 1605107557.390885, "Dimensions": {"mode1": 23, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107557.390868}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6806437875748922, "sum": 0.6806437875748922, "min": 0.6806437875748922}}, "EndTime": 1605107557.390949, "Dimensions": {"mode1": 24, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107557.390932}

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#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6804951244692562, "sum": 0.6804951244692562, "min": 0.6804951244692562}}, "EndTime": 1605107557.391069, "Dimensions": {"mode1": 26, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107557.391058}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6817348048125264, "sum": 0.6817348048125264, "min": 0.6817348048125264}}, "EndTime": 1605107557.391118, "Dimensions": {"mode1": 27, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107557.391102}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6804449089035132, "sum": 0.6804449089035132, "min": 0.6804449089035132}}, "EndTime": 1605107557.391178, "Dimensions": {"mode1": 28, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107557.391161}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6799719350126621, "sum": 0.6799719350126621, "min": 0.6799719350126621}}, "EndTime": 1605107557.391233, "Dimensions": {"mode1": 29, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107557.391216}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6804414558655507, "sum": 0.6804414558655507, "min": 0.6804414558655507}}, "EndTime": 1605107557.391297, "Dimensions": {"mode1": 30, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107557.39128}

#metrics {"Metrics": {"validation_binary_classification_cross_entropy_objective": {"count": 1, "max": 0.6799720348362649, "sum": 0.6799720348362649, "min": 0.6799720348362649}}, "EndTime": 1605107557.39135, "Dimensions": {"mode1": 31, "Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner", "epoch": 14}, "StartTime": 1605107557.391333}

[11/11/2020 15:12:37 INFO 140525173397312] #quality_metric: host=algo-1, epoch=14, validation_binary_classification_cross_entropy_objective <loss>=0.124000543413
[11/11/2020 15:12:37 INFO 140525173397312] #early_stopping_criteria_metric: host=algo-1, epoch=14, criteria=sampled_accuracy, value=0.95979811125
[11/11/2020 15:12:37 INFO 140525173397312] Epoch 14: Loss improved. Updating best model
[11/11/2020 15:12:37 INFO 140525173397312] Saving model for epoch: 14
[11/11/2020 15:12:37 INFO 140525173397312] Saved checkpoint to "/tmp/tmpazNPxA/mx-mod-0000.params"
[11/11/2020 15:12:37 INFO 140525173397312] #progress_metric: host=algo-1, completed 100 % of epochs
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Batches Since Last Reset": {"count": 1, "max": 455, "sum": 455.0, "min": 455}, "Number of Records Since Last Reset": {"count": 1, "max": 454904, "sum": 454904.0, "min": 454904}, "Total Batches Seen": {"count": 1, "max": 6837, "sum": 6837.0, "min": 6837}, "Total Records Seen": {"count": 1, "max": 6835560, "sum": 6835560.0, "min": 6835560}, "Max Records Seen Between Resets": {"count": 1, "max": 454904, "sum": 454904.0, "min": 454904}, "Reset Count": {"count": 1, "max": 17, "sum": 17.0, "mi

```

```
n": 17}}, "EndTime": 1605107557.397373, "Dimensions": {"Host": "algo-1", "Met a": "training_data_iter", "Operation": "training", "Algorithm": "Linear Lear ner", "epoch": 14}, "StartTime": 1605107541.019276}

[11/11/2020 15:12:37 INFO 140525173397312] #throughput_metric: host=algo-1, t rain throughput=27774.9031701 records/second
[11/11/2020 15:12:37 WARNING 140525173397312] wait_for_all_workers will not s ync workers since the kv store is not running distributed
[11/11/2020 15:12:37 WARNING 140525173397312] wait_for_all_workers will not s ync workers since the kv store is not running distributed
[2020-11-11 15:12:38.648] [tensorio] [info] epoch_stats={"data_pipeline": "/o pt/ml/input/data/validation", "epoch": 47, "duration": 1235, "num_examples": 57, "num_bytes": 9325532}
[11/11/2020 15:12:39 INFO 140525173397312] #early_stopping_criteria_metric: h ost=algo-1, epoch=14, criteria=sampled_accuracy, value=0.95979811125
[11/11/2020 15:12:39 INFO 140525173397312] Epoch 14: Loss improved. Updating best model
[2020-11-11 15:12:39.629] [tensorio] [info] epoch_stats={"data_pipeline": "/o pt/ml/input/data/validation", "epoch": 49, "duration": 246, "num_examples": 57, "num_bytes": 9325532}
[11/11/2020 15:12:39 INFO 140525173397312] #validation_score (algo-1) : ('bin ary_classification_cross_entropy_objective', 0.10885181671529529)
[11/11/2020 15:12:39 INFO 140525173397312] #validation_score (algo-1) : ('bin ary_classification_accuracy', 0.9597805251217839)
[11/11/2020 15:12:39 INFO 140525173397312] #validation_score (algo-1) : ('bin ary_f_1.000', 0.9590781398178467)
[11/11/2020 15:12:39 INFO 140525173397312] #validation_score (algo-1) : ('pre cision', 0.9792458345513008)
[11/11/2020 15:12:39 INFO 140525173397312] #validation_score (algo-1) : ('rec all', 0.9397243942634734)
[11/11/2020 15:12:39 INFO 140525173397312] #validation_score (algo-1) : ('roc _auc_score', 0.9914991879135753)
[11/11/2020 15:12:39 INFO 140525173397312] #quality_metric: host=algo-1, vali dation binary_classification_cross_entropy <loss>=0.108851816715
[11/11/2020 15:12:39 INFO 140525173397312] #quality_metric: host=algo-1, vali dation binary_classification_accuracy <score>=0.959780525122
[11/11/2020 15:12:39 INFO 140525173397312] #quality_metric: host=algo-1, vali dation binary_f_1.000 <score>=0.959078139818
[11/11/2020 15:12:39 INFO 140525173397312] #quality_metric: host=algo-1, vali dation precision <score>=0.979245834551
[11/11/2020 15:12:39 INFO 140525173397312] #quality_metric: host=algo-1, vali dation recall <score>=0.939724394263
[11/11/2020 15:12:39 INFO 140525173397312] #quality_metric: host=algo-1, vali dation roc_auc_score <score>=0.991499187914
[11/11/2020 15:12:39 INFO 140525173397312] Best model found for hyperparamete rs: {"lr_scheduler_step": 100, "wd": 0.0001, "optimizer": "adam", "lr_scheduler_factor": 0.99, "l1": 0.0, "learning_rate": 0.1, "lr_scheduler_minimum_lr": 1e-05}
[11/11/2020 15:12:39 INFO 140525173397312] Saved checkpoint to "/tmp/tmpMLsAj/j/mx-mod-0000.params"
[2020-11-11 15:12:39.656] [tensorio] [info] epoch_stats={"data_pipeline": "/o pt/ml/input/data/test", "epoch": 0, "duration": 245315, "num_examples": 1, "n um_bytes": 164000}
[2020-11-11 15:12:39.850] [tensorio] [info] epoch_stats={"data_pipeline": "/o pt/ml/input/data/test", "epoch": 1, "duration": 193, "num_examples": 57, "num _bytes": 9325532}
```

```
#metrics {"Metrics": {"Max Batches Seen Between Resets": {"count": 1, "max": 57, "sum": 57.0, "min": 57}, "Number of Batches Since Last Reset": {"count": 1, "max": 57, "sum": 57.0, "min": 57}, "Number of Records Since Last Reset": {"count": 1, "max": 56863, "sum": 56863.0, "min": 56863}, "Total Batches Seen": {"count": 1, "max": 57, "sum": 57.0, "min": 57}, "Total Records Seen": {"count": 1, "max": 56863, "sum": 56863.0, "min": 56863}, "Max Records Seen Between Resets": {"count": 1, "max": 56863, "sum": 56863.0, "min": 56863}, "Reset Count": {"count": 1, "max": 1, "sum": 1.0, "min": 1}}, "EndTime": 1605107559.868794, "Dimensions": {"Host": "algo-1", "Meta": "test_data_iter", "Operation": "training", "Algorithm": "Linear Learner"}, "StartTime": 1605107559.655908}
```

```
[11/11/2020 15:12:39 INFO 140525173397312] #test_score (algo-1) : ('binary_classification_cross_entropy_objective', 0.11031582994365295)
[11/11/2020 15:12:39 INFO 140525173397312] #test_score (algo-1) : ('binary_classification_accuracy', 0.9586901851819285)
[11/11/2020 15:12:39 INFO 140525173397312] #test_score (algo-1) : ('binary_f_1.000', 0.9578632034010799)
[11/11/2020 15:12:39 INFO 140525173397312] #test_score (algo-1) : ('precision', 0.9792767018779343)
[11/11/2020 15:12:39 INFO 140525173397312] #test_score (algo-1) : ('recall', 0.9373661482287681)
[11/11/2020 15:12:39 INFO 140525173397312] #test_score (algo-1) : ('roc_auc_score', 0.9912827921762464)
[11/11/2020 15:12:39 INFO 140525173397312] #quality_metric: host=algo-1, test binary_classification_cross_entropy_objective <loss>=0.110315829944
[11/11/2020 15:12:39 INFO 140525173397312] #quality_metric: host=algo-1, test binary_classification_accuracy <score>=0.958690185182
[11/11/2020 15:12:39 INFO 140525173397312] #quality_metric: host=algo-1, test binary_f_1.000 <score>=0.957863203401
[11/11/2020 15:12:39 INFO 140525173397312] #quality_metric: host=algo-1, test precision <score>=0.979276701878
[11/11/2020 15:12:39 INFO 140525173397312] #quality_metric: host=algo-1, test recall <score>=0.937366148229
[11/11/2020 15:12:39 INFO 140525173397312] #quality_metric: host=algo-1, test roc_auc_score <score>=0.991282792176
#metrics {"Metrics": {"totaltime": {"count": 1, "max": 245838.01889419556, "sum": 245838.01889419556, "min": 245838.01889419556}, "finalize.time": {"count": 1, "max": 2255.6560039520264, "sum": 2255.6560039520264, "min": 2255.6560039520264}, "initialize.time": {"count": 1, "max": 261.1198425292969, "sum": 261.1198425292969, "min": 261.1198425292969}, "check_early_stopping.time": {"count": 16, "max": 1.096963882446289, "sum": 15.22970199584961, "min": 0.8041858673095703}, "setuptime": {"count": 1, "max": 39.212942123413086, "sum": 39.212942123413086, "min": 39.212942123413086}, "update.time": {"count": 15, "max": 16905.92885017395, "sum": 242740.9877770996, "min": 15725.583791732788}, "epochs": {"count": 1, "max": 15, "sum": 15.0, "min": 15}}, "EndTime": 1605107559.874522, "Dimensions": {"Host": "algo-1", "Operation": "training", "Algorithm": "Linear Learner"}, "StartTime": 1605107314.328964}
```

2020-11-11 15:13:33 Uploading - Uploading generated training model

2020-11-11 15:13:40 Completed - Training job completed

Training seconds: 378

Billable seconds: 378

Question: What can you deduce from evaluating the training job?

Answer: Test recall improved a lot by using SMOTE on the training dataset. We are looking at the recall value, which is at 93% now. This is great, but can we still improve this number by changing some parameters? Let's try to use hyperparameter optimization to see if it would improve.

Hyperparameter optimization

Another part of the model tuning phase is to perform hyperparameter optimization. This section gives you an opportunity to tune your hyperparameters to see the extent to which tuning improves your model performance. Use the following template code to help you get started launching an Amazon SageMaker hyperparameter tuning job and viewing the evaluation metrics. Use the following questions to help guide you through the rest of the section.

Key questions to consider:

1. How does the outcome of your objective metric of choice change as timing of your tuning job increases?
What's the relationship between the different objective metrics you're getting and time?
2. What is the correlation between your objective metric and the individual hyperparameters? Is there a hyperparameter that has a strong correlation with your objective metric? If so, what might you do to leverage this strong correlation?
3. Analyze the performance of your model after hyperparameter tuning. Is current performance sufficient for what you need to solve your business problem?

Project presentation: Record key decisions and methods you use in this section in your project presentations, as well as any new performance metrics you obtain after evaluating your model again.

```
In [51]: from sagemaker.tuner import IntegerParameter, CategoricalParameter, ContinuousParameter, HyperparameterTuner

hyperparameter_ranges = {'wd': ContinuousParameter(1e-5, 1),
                        'l1': ContinuousParameter(1e-5, 0.01),
                        'learning_rate': ContinuousParameter(1e-4, 0.1)
                       }

objective_metric_name = 'test:recall'

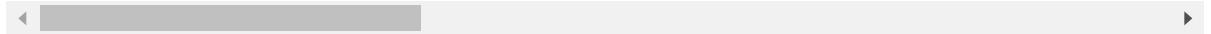
tuner = HyperparameterTuner(linear_estimator_smote,
                             objective_metric_name,
                             hyperparameter_ranges,
                             max_jobs=10,
                             max_parallel_jobs=3)

tuner.fit([train_records_smote, val_records_smote, test_records_smote], include_cls_metadata=False)
```

Defaulting to the only supported framework/algorithm version: 1. Ignoring framework/algorithm version: 1.

Defaulting to the only supported framework/algorithm version: 1. Ignoring framework/algorithm version: 1.

.....



Track hyperparameter tuning job progress

After you launch a tuning job, you can see its progress by calling the `describe_tuning_job` API. The output from `describe-tuning-job` is a JSON object that contains information about the current state of the tuning job. You can call `list_training_jobs_for_tuning_job` to see a detailed list of the training jobs that the tuning job launched.

```
In [52]: client = boto3.Session().client('sagemaker')
tuning_job_result = client.describe_hyper_parameter_tuning_job(HyperParameterTuningJobName=tuner.latest_tuning_job.job_name)

status = tuning_job_result['HyperParameterTuningJobStatus']
while status != 'Completed':
    print('Reminder: the tuning job has not been completed.')

    job_count = tuning_job_result['TrainingJobStatusCounters']['Completed']
    print("%d training jobs have completed" % job_count)

    time.sleep(180)

    tuning_job_result = client.describe_hyper_parameter_tuning_job(HyperParameterTuningJobName=tuner.latest_tuning_job.job_name)
    status = tuning_job_result['HyperParameterTuningJobStatus']

print("\n\n All training jobs have completed")
is_minimize = (tuning_job_result['HyperParameterTuningJobConfig']['HyperParameterTuningJobObjective']['Type'] != 'Maximize')
objective_name = tuning_job_result['HyperParameterTuningJobConfig']['HyperParameterTuningJobObjective']['MetricName']
```

All training jobs have completed

```
In [53]: from pprint import pprint
if tuning_job_result.get('BestTrainingJob',None):
    print("Best model found so far:")
    pprint(tuning_job_result['BestTrainingJob'])
else:
    print("No training jobs have reported results yet.")

Best model found so far:
{'CreationTime': datetime.datetime(2020, 11, 11, 15, 14, 32, tzinfo=tzlocal()),
 'FinalHyperParameterTuningJobObjectiveMetric': {'MetricName': 'test:recall',
                                                'Value': 0.938875794410705
                                               },
 'ObjectiveStatus': 'Succeeded',
 'TrainingEndTime': datetime.datetime(2020, 11, 11, 15, 18, 43, tzinfo=tzlocal()),
 'TrainingJobArn': 'arn:aws:sagemaker:us-west-2:630754909290:training-job/linear-learner-201111-1514-003-66b4979d',
 'TrainingJobName': 'linear-learner-201111-1514-003-66b4979d',
 'TrainingJobStatus': 'Completed',
 'TrainingStartTime': datetime.datetime(2020, 11, 11, 15, 16, 56, tzinfo=tzlocal()),
 'TunedHyperParameters': {'l1': '0.001138289130301599',
                           'learning_rate': '0.008614629648212606',
                           'wd': '4.3507979769071425e-05'}}}
```

Fetch all results as a DataFrame

You can list hyperparameters and objective metrics of all training jobs and pick up the training job with the best objective metric.

```
In [54]: tuner_analytics = sagemaker.HyperparameterTuningJobAnalytics(tuner.latest_tuning_job.job_name)

full_df = tuner_analytics.dataframe()

if len(full_df) > 0:
    df = full_df[full_df['FinalObjectiveValue'] > -float('inf')]
    if len(df) > 0:
        df = df.sort_values('FinalObjectiveValue', ascending=is_minimize)
        print("Number of training jobs with valid objective: %d" % len(df))
        print({"lowest":min(df['FinalObjectiveValue']), "highest": max(df['FinalObjectiveValue'])})
        pd.set_option('display.max_colwidth', -1) # Don't truncate TrainingJobName
    else:
        print("No training jobs have reported valid results yet.")

df
```

Number of training jobs with valid objective: 10
 {'lowest': 0.8726608753204346, 'highest': 0.9388757944107056}

Out[54]:

	I1	learning_rate	wd	TrainingJobName	TrainingJobStatus	FinalObjectiveValue	Ti
7	0.001138	0.008615	0.000044	linear-learner-201111-1514-003-66b4979d	Completed	0.938876	
5	0.000481	0.088025	0.033283	linear-learner-201111-1514-005-e3d66103	Completed	0.937015	
0	0.000518	0.100000	0.004962	linear-learner-201111-1514-010-0e3c0489	Completed	0.936699	
4	0.002047	0.042787	0.000013	linear-learner-201111-1514-006-4c73ef44	Completed	0.935856	
2	0.000014	0.035315	0.000070	linear-learner-201111-1514-008-050d2a4c	Completed	0.934101	
3	0.000017	0.021446	0.000011	linear-learner-201111-1514-007-149fa479	Completed	0.933364	
1	0.000022	0.016784	0.000356	linear-learner-201111-1514-009-ab8d7686	Completed	0.932837	
8	0.003565	0.003355	0.000261	linear-learner-201111-1514-002-f37fc80f	Completed	0.929080	
6	0.000364	0.063797	0.784785	linear-learner-201111-1514-004-57da7bd0	Completed	0.913141	
9	0.004526	0.000212	0.000250	linear-learner-201111-1514-001-30e69f66	Completed	0.872661	



Question: Does the model tuning help?

Answer: The tuned model gives recall that is around the same value on the test set as the non-tuned model when it comes to getting the fraud data points right.

See tuning job results vs. time

Next you will show how the objective metric changes over time, as the tuning job progresses. For Bayesian strategy, you should expect to see a general trend toward better results, but this progress will not be steady as the algorithm needs to balance exploration of new areas of parameter space against exploitation of known good areas. This can give you a sense of whether the number of training jobs is sufficient for the complexity of your search space.

```
In [55]: import bokeh
import bokeh.io
bokeh.io.output_notebook()
from bokeh.plotting import figure, show
from bokeh.models import HoverTool

class HoverHelper():

    def __init__(self, tuning_analytics):
        self.tuner = tuning_analytics

    def hovertool(self):
        tooltips = [
            ("FinalObjectiveValue", "@FinalObjectiveValue"),
            ("TrainingJobName", "@TrainingJobName"),
        ]
        for k in self.tuner.hyperparameter_ranges().keys():
            tooltips.append( (k, "@{%s}" % k) )

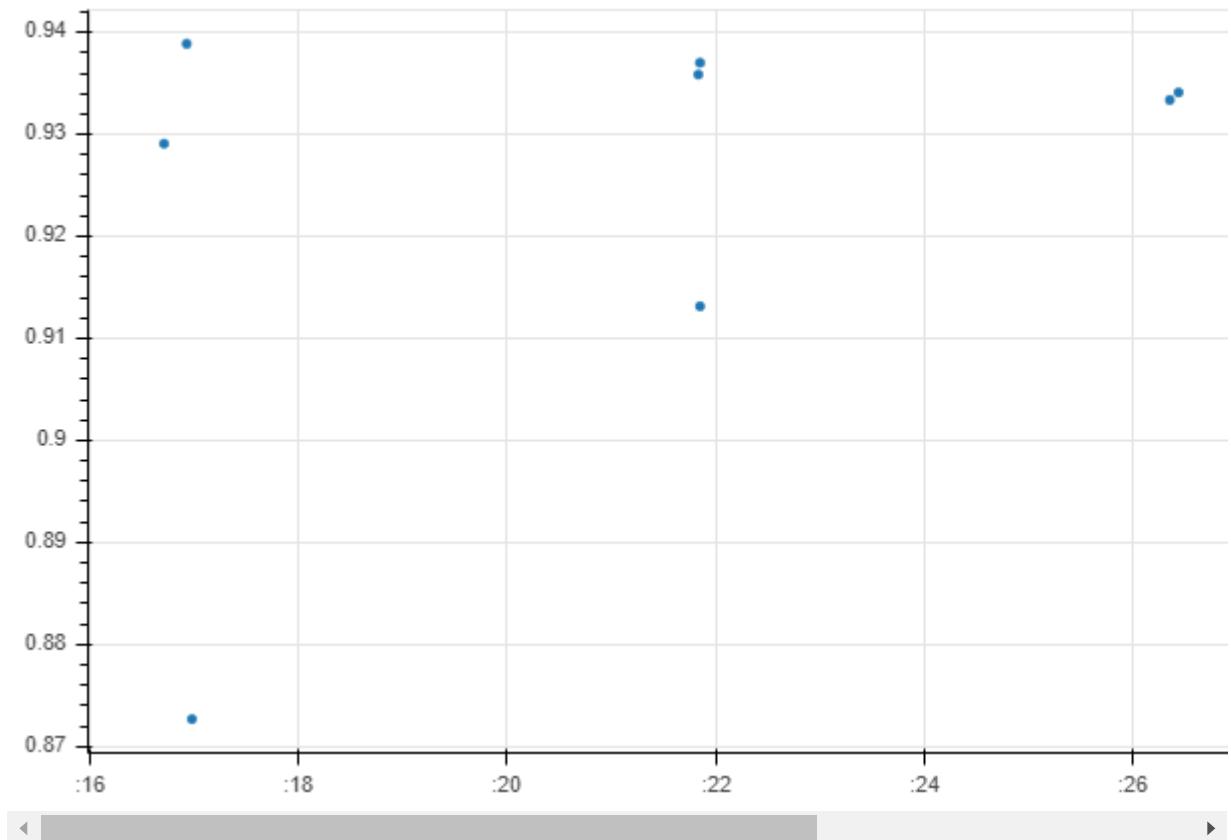
        ht = HoverTool(tooltips=tooltips)
        return ht

    def tools(self, standard_tools='pan,crosshair,wheel_zoom,zoom_in,zoom_out,
              undo,reset'):
        return [self.hovertool(), standard_tools]

hover = HoverHelper(tuner)

p = figure(plot_width=900, plot_height=400, tools=hover.tools(), x_axis_type=
'datetime')
p.circle(source=df, x='TrainingStartTime', y='FinalObjectiveValue')
show(p)
```

(<https://S0kchdS.d1.g>)0 successfully loaded.



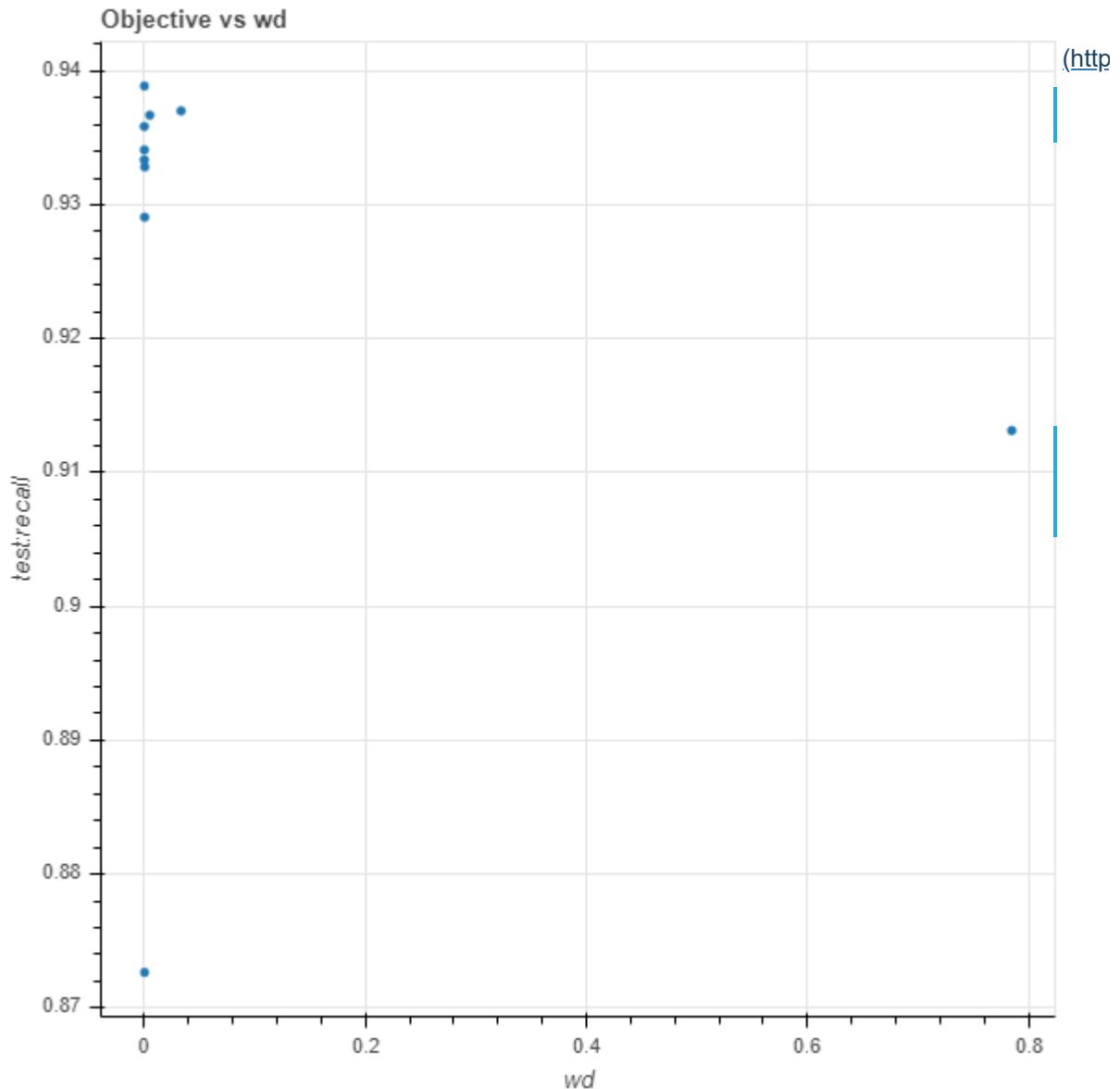
Analyze the correlation between objective metric and individual hyperparameters

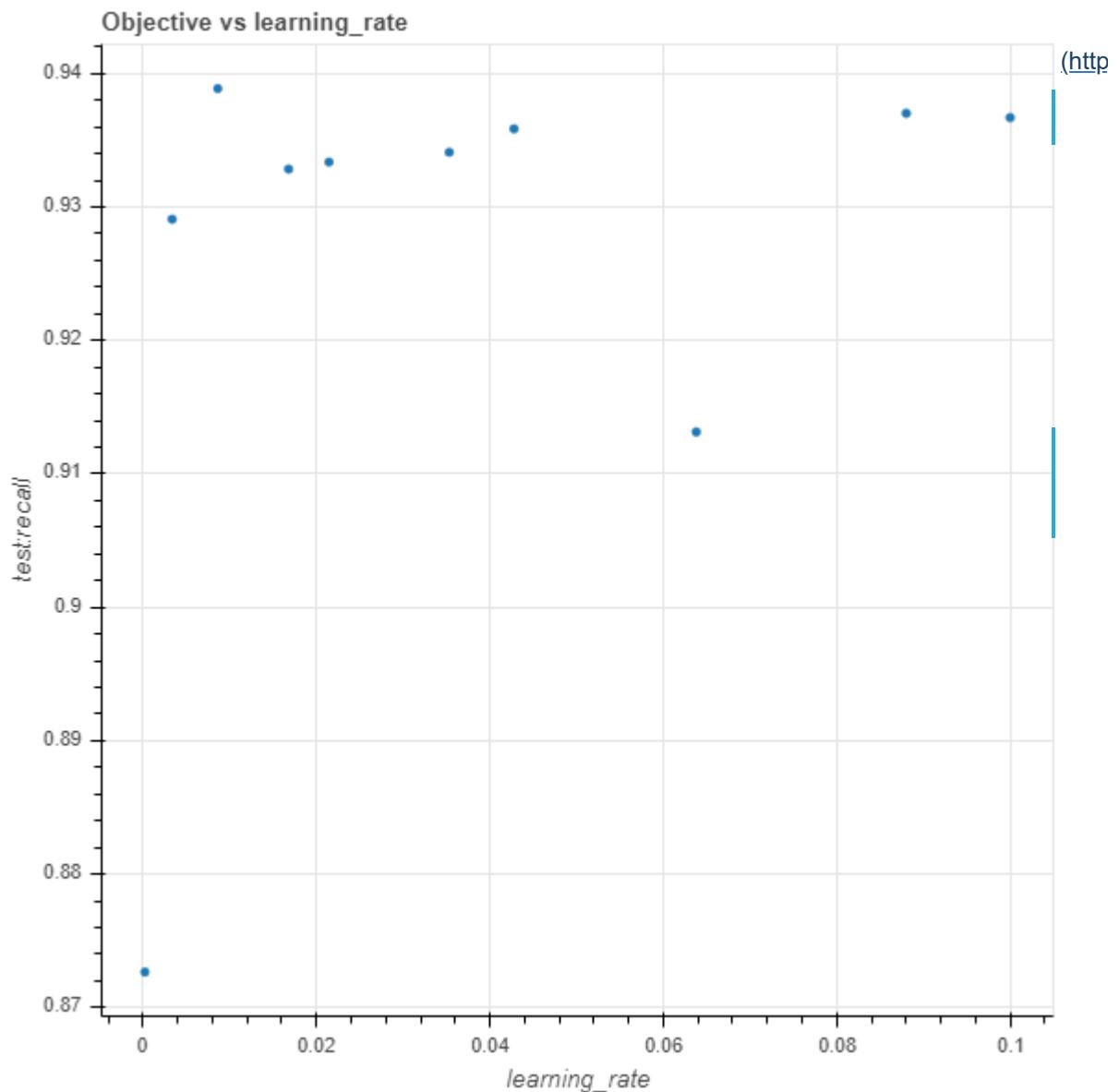
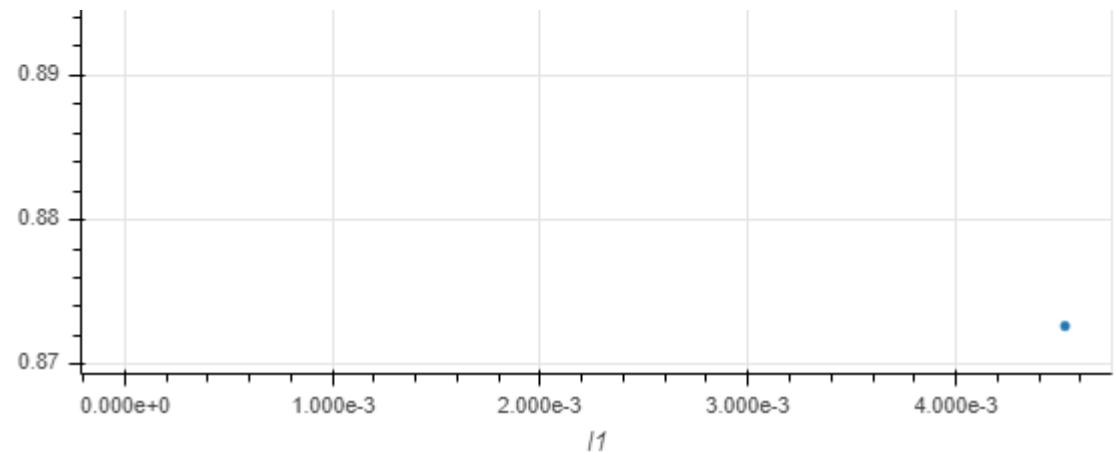
Now that you have finished a tuning job, you may want to know the correlation between your objective metric and individual hyperparameters you've selected to tune. Having that insight will help you decide whether it makes sense to adjust search ranges for certain hyperparameters and start another tuning job. For example, if you see a positive trend between the objective metric and a numerical hyperparameter, you probably want to set a higher tuning range for that hyperparameter in your next tuning job.

The following cell draws a graph for each hyperparameter to show its correlation with your objective metric.

```
In [56]: ranges = tuner_analytics.tuning_ranges
figures = []
for hp_name, hp_range in ranges.items():
    categorical_args = {}
    if hp_range.get('Values'):
        # This is marked as categorical. Check if all options are actually numbers.
        def is_num(x):
            try:
                float(x)
                return 1
            except:
                return 0
        vals = hp_range['Values']
        if sum([is_num(x) for x in vals]) == len(vals):
            # Bokeh has issues plotting a "categorical" range that's actually numeric, so plot as numeric
            print("Hyperparameter %s is tuned as categorical, but all values are numeric" % hp_name)
        else:
            # Set up extra options for plotting categoricals. A bit tricky when they're actually numbers.
            categorical_args['x_range'] = vals

    # Now plot it
    p = figure(plot_width=600, plot_height=600,
               title="Objective vs %s" % hp_name,
               tools=hover.tools(),
               x_axis_label=hp_name, y_axis_label=objective_name,
               **categorical_args)
    p.circle(source=df, x=hp_name, y='FinalObjectiveValue')
    figures.append(p)
show(bokeh.layouts.Column(*figures))
```





Deploy this as your final model and evaluate it on the test set.

```
In [57]: tuned_model_deploy = tuner.deploy(initial_instance_count=1, instance_type='ml.m4.xlarge')
```

```
2020-11-11 15:18:43 Starting - Preparing the instances for training  
2020-11-11 15:18:43 Downloading - Downloading input data  
2020-11-11 15:18:43 Training - Training image download completed. Training in progress.  
2020-11-11 15:18:43 Uploading - Uploading generated training model  
2020-11-11 15:18:43 Completed - Training job completed
```

Defaulting to the only supported framework/algorithm version: 1. Ignoring framework/algorithm version: 1.

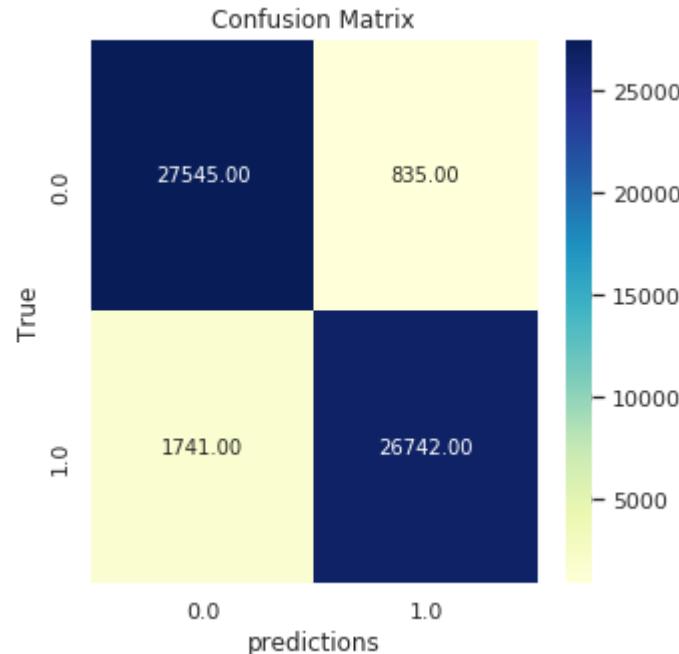
-----!

```
In [58]: predict_batches(tuned_model_deploy, test_features, test_labels)
```

Accuracy: 0.9546981341118126

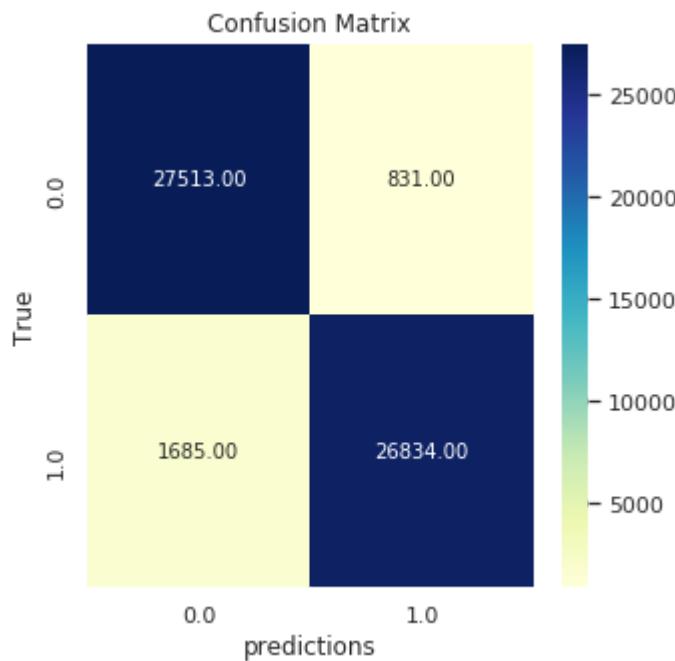
Precision: 0.9697211444319541

Recall: 0.938875820664958



In [59]: `predict_batches(tuned_model_deploy, val_features, val_labels)`

Accuracy: 0.9557533017955436
 Precision: 0.9699620459063799
 Recall: 0.9409165819278376



OPTIONAL: Try the XGBoost algorithm

Moving onto training, first we'll need to specify the locations of the XGBoost algorithm containers.

```
In [60]: containers = {'us-west-2': '433757028032.dkr.ecr.us-west-2.amazonaws.com/xgboost:latest',
                    'us-east-1': '811284229777.dkr.ecr.us-east-1.amazonaws.com/xgboost:latest',
                    'us-east-2': '825641698319.dkr.ecr.us-east-2.amazonaws.com/xgboost:latest',
                    'eu-west-1': '685385470294.dkr.ecr.eu-west-1.amazonaws.com/xgboost:latest'}

bucket = sess.default_bucket()
prefix = 'sagemaker/xgboost-creditcard'

from sagemaker.amazon.amazon_estimator import image_uris
container = image_uris.retrieve('xgboost', boto3.Session().region_name, '1.0-1')
```

Then, because you're training with the CSV file format, create s3_inputs that the training function can use as a pointer to the files in Amazon S3.

```
In [61]: train_features_balanced = balanced_df.drop(['Target'], axis=1).values
train_labels_balanced = balanced_df['Target'].values

train_features_label = np.insert(train_features_balanced, 0, train_labels_balanced, axis=1)
val_features_label = np.insert(val_features, 0, val_labels, axis=1)
test_features_label = np.insert(test_features, 0, test_labels, axis=1)

np.savetxt("train.csv", train_features_label, delimiter=",")
np.savetxt("validation.csv", val_features_label, delimiter ",")

boto3.Session().resource('s3').Bucket(bucket).Object(os.path.join(prefix, 'train/train.csv')).upload_file('train.csv')
boto3.Session().resource('s3').Bucket(bucket).Object(os.path.join(prefix, 'validation/validation.csv')).upload_file('validation.csv')

s3_input_train = sagemaker.inputs.TrainingInput(s3_data='s3://{}//{}//train'.format(bucket, prefix), content_type='csv')
s3_input_validation = sagemaker.inputs.TrainingInput(s3_data='s3://{}//{}//validation/'.format(bucket, prefix), content_type='csv')
```

Now, you can specify a few parameters like what type of training instances you'd like to use and how many, as well as the XGBoost hyperparameters. A few key hyperparameters are:

- `max_depth` : Controls how deep each tree within the algorithm can be built. Deeper trees can lead to better fit but are more computationally expensive and can lead to overfitting. There is typically some trade-off in model performance that needs to be explored between a large number of shallow trees and a smaller number of deeper trees.
- `subsample` : Controls sampling of the training data. This technique can help reduce overfitting, but setting it too low can also starve the model of data.
- `num_round` : Controls the number of boosting rounds. This is essentially the subsequent models that are trained using the residuals of previous iterations. Again, more rounds should produce a better fit on the training data but can be computationally expensive or lead to overfitting.
- `eta` : Controls how aggressive each round of boosting is. Larger values lead to more conservative boosting.
- `gamma` : Controls how aggressively trees are grown. Larger values lead to more conservative models.

```
In [62]: xgb = sagemaker.estimator.Estimator(container,
                                             role,
                                             instance_count=1,
                                             instance_type='ml.m4.xlarge',
                                             output_path='s3://{}//{}/output'.format(bucket, prefix),
                                             sagemaker_session=sess)
xgb.set_hyperparameters(max_depth=10,
                        eta=0.2,
                        gamma=4,
                        min_child_weight=1,
                        subsample=0.8,
                        silent=0,
                        objective='binary:logistic',
                        eval_metric='auc',
                        num_round=100)
```

First, you need to specify training parameters to the estimator. This includes:

- The XGBoost algorithm container
- The IAM role to use
- Training instance type and count
- Amazon S3 location for output data
- Algorithm hyperparameters

And then a `.fit()` function, which specifies the Amazon S3 location for output data. In this case, you have both a training and validation set that are passed in.

```
In [63]: xgb.fit({'train': s3_input_train, 'validation': s3_input_validation})
```

```
2020-11-11 15:41:45 Starting - Starting the training job...
2020-11-11 15:41:48 Starting - Launching requested ML instances.....
2020-11-11 15:43:13 Starting - Preparing the instances for training.....
2020-11-11 15:44:40 Downloading - Downloading input data
2020-11-11 15:44:40 Training - Downloading the training image...
2020-11-11 15:45:15 Uploading - Uploading generated training model.INFO:sagemaker-containers:Imported framework sagemaker_xgboost_container.training
INFO:sagemaker-containers:Failed to parse hyperparameter eval_metric value according to Json.
Returning the value itself
INFO:sagemaker-containers:Failed to parse hyperparameter objective value binary:logistic to Json.
Returning the value itself
INFO:sagemaker-containers:No GPUs detected (normal if no gpus installed)
INFO:sagemaker_xgboost_container.training:Running XGBoost Sagemaker in algorithm mode
INFO:root:Determined delimiter of CSV input is ','
INFO:root:Determined delimiter of CSV input is ','
INFO:root:Determined delimiter of CSV input is ','
[15:45:12] 782x29 matrix with 22678 entries loaded from /opt/ml/input/data/train?format=csv&label_column=0&delimiter=,
INFO:root:Determined delimiter of CSV input is ','
[15:45:12] 56863x29 matrix with 1649027 entries loaded from /opt/ml/input/data/validation?format=csv&label_column=0&delimiter=,
INFO:root:Single node training.
INFO:root:Train matrix has 782 rows
INFO:root:Validation matrix has 56863 rows
[0]#011train-auc:0.97733#011validation-auc:0.97034
[1]#011train-auc:0.98634#011validation-auc:0.97805
[2]#011train-auc:0.98778#011validation-auc:0.97948
[3]#011train-auc:0.98862#011validation-auc:0.98128
[4]#011train-auc:0.99258#011validation-auc:0.98352
[5]#011train-auc:0.99390#011validation-auc:0.98422
[6]#011train-auc:0.99421#011validation-auc:0.98616
[7]#011train-auc:0.99584#011validation-auc:0.98800
[8]#011train-auc:0.99558#011validation-auc:0.98799
[9]#011train-auc:0.99605#011validation-auc:0.98801
[10]#011train-auc:0.99619#011validation-auc:0.98847
[11]#011train-auc:0.99651#011validation-auc:0.98856
[12]#011train-auc:0.99662#011validation-auc:0.98903
[13]#011train-auc:0.99663#011validation-auc:0.98934
[14]#011train-auc:0.99662#011validation-auc:0.98952
[15]#011train-auc:0.99688#011validation-auc:0.99016
[16]#011train-auc:0.99688#011validation-auc:0.99016
[17]#011train-auc:0.99681#011validation-auc:0.99006
[18]#011train-auc:0.99693#011validation-auc:0.99023
[19]#011train-auc:0.99704#011validation-auc:0.99008
[20]#011train-auc:0.99706#011validation-auc:0.99012
[21]#011train-auc:0.99706#011validation-auc:0.99011
[22]#011train-auc:0.99715#011validation-auc:0.99004
[23]#011train-auc:0.99765#011validation-auc:0.99072
[24]#011train-auc:0.99765#011validation-auc:0.99072
[25]#011train-auc:0.99773#011validation-auc:0.99069
[26]#011train-auc:0.99794#011validation-auc:0.99081
[27]#011train-auc:0.99794#011validation-auc:0.99081
```

```
[28]#011train-auc:0.99818#011validation-auc:0.99125
[29]#011train-auc:0.99836#011validation-auc:0.99144
[30]#011train-auc:0.99836#011validation-auc:0.99144
[31]#011train-auc:0.99836#011validation-auc:0.99144
[32]#011train-auc:0.99854#011validation-auc:0.99170
[33]#011train-auc:0.99854#011validation-auc:0.99170
[34]#011train-auc:0.99854#011validation-auc:0.99170
[35]#011train-auc:0.99854#011validation-auc:0.99170
[36]#011train-auc:0.99858#011validation-auc:0.99184
[37]#011train-auc:0.99858#011validation-auc:0.99184
[38]#011train-auc:0.99858#011validation-auc:0.99184
[39]#011train-auc:0.99858#011validation-auc:0.99184
[40]#011train-auc:0.99858#011validation-auc:0.99184
[41]#011train-auc:0.99858#011validation-auc:0.99184
[42]#011train-auc:0.99874#011validation-auc:0.99218
[43]#011train-auc:0.99874#011validation-auc:0.99218
[44]#011train-auc:0.99874#011validation-auc:0.99218
[45]#011train-auc:0.99874#011validation-auc:0.99218
[46]#011train-auc:0.99874#011validation-auc:0.99218
[47]#011train-auc:0.99874#011validation-auc:0.99218
[48]#011train-auc:0.99874#011validation-auc:0.99218
[49]#011train-auc:0.99874#011validation-auc:0.99218
[50]#011train-auc:0.99874#011validation-auc:0.99218
[51]#011train-auc:0.99874#011validation-auc:0.99218
[52]#011train-auc:0.99874#011validation-auc:0.99218
[53]#011train-auc:0.99874#011validation-auc:0.99218
[54]#011train-auc:0.99874#011validation-auc:0.99230
[55]#011train-auc:0.99874#011validation-auc:0.99230
[56]#011train-auc:0.99874#011validation-auc:0.99230
[57]#011train-auc:0.99874#011validation-auc:0.99230
[58]#011train-auc:0.99874#011validation-auc:0.99230
[59]#011train-auc:0.99874#011validation-auc:0.99230
[60]#011train-auc:0.99874#011validation-auc:0.99230
[61]#011train-auc:0.99874#011validation-auc:0.99230
[62]#011train-auc:0.99870#011validation-auc:0.99221
[63]#011train-auc:0.99870#011validation-auc:0.99221
[64]#011train-auc:0.99870#011validation-auc:0.99221
[65]#011train-auc:0.99870#011validation-auc:0.99221
[66]#011train-auc:0.99870#011validation-auc:0.99221
[67]#011train-auc:0.99870#011validation-auc:0.99221
[68]#011train-auc:0.99870#011validation-auc:0.99221
[69]#011train-auc:0.99870#011validation-auc:0.99221
[70]#011train-auc:0.99870#011validation-auc:0.99221
[71]#011train-auc:0.99882#011validation-auc:0.99229
[72]#011train-auc:0.99905#011validation-auc:0.99266
[73]#011train-auc:0.99905#011validation-auc:0.99266
[74]#011train-auc:0.99905#011validation-auc:0.99266
[75]#011train-auc:0.99905#011validation-auc:0.99266
[76]#011train-auc:0.99905#011validation-auc:0.99266
[77]#011train-auc:0.99905#011validation-auc:0.99266
[78]#011train-auc:0.99905#011validation-auc:0.99266
[79]#011train-auc:0.99905#011validation-auc:0.99266
[80]#011train-auc:0.99905#011validation-auc:0.99266
[81]#011train-auc:0.99905#011validation-auc:0.99266
[82]#011train-auc:0.99905#011validation-auc:0.99266
[83]#011train-auc:0.99905#011validation-auc:0.99266
```

```
[84]#011train-auc:0.99905#011validation-auc:0.99266
[85]#011train-auc:0.99905#011validation-auc:0.99266
[86]#011train-auc:0.99905#011validation-auc:0.99266
[87]#011train-auc:0.99905#011validation-auc:0.99266
[88]#011train-auc:0.99905#011validation-auc:0.99266
[89]#011train-auc:0.99905#011validation-auc:0.99266
[90]#011train-auc:0.99905#011validation-auc:0.99266
[91]#011train-auc:0.99905#011validation-auc:0.99266
[92]#011train-auc:0.99905#011validation-auc:0.99266
[93]#011train-auc:0.99905#011validation-auc:0.99266
[94]#011train-auc:0.99905#011validation-auc:0.99266
[95]#011train-auc:0.99905#011validation-auc:0.99266
[96]#011train-auc:0.99905#011validation-auc:0.99266
[97]#011train-auc:0.99905#011validation-auc:0.99266
[98]#011train-auc:0.99905#011validation-auc:0.99266
[99]#011train-auc:0.99905#011validation-auc:0.99266
```

2020-11-11 15:45:22 Completed - Training job completed

Training seconds: 65

Billable seconds: 65

Hosting

Now that you've trained the XGBoost algorithm on the data, deploy a model that's hosted behind a real-time endpoint.

Deploy your model on Amazon SageMaker.

```
In [64]: from sagemaker.predictor import CSVSerializer

xgb_predictor = xgb.deploy(initial_instance_count=1,
                           instance_type='ml.m4.xlarge',
                           serializer=CSVSerializer())
```

-----!

```
In [65]: from sagemaker.predictor import csv_serializer

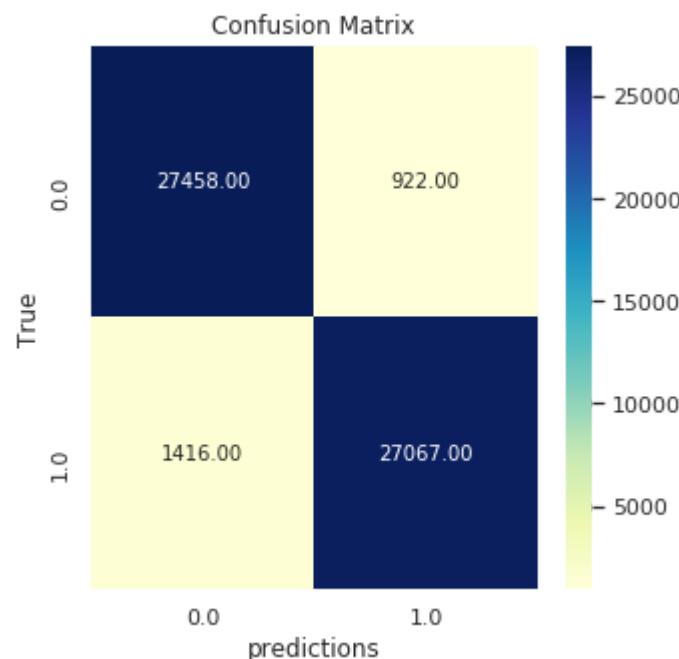
def predict_xgboost(model, data, labels, rows=500):

    #model.content_type = 'text/csv'
    #model.serializer = csv_serializer
    #model.deserializer = None

    split_array = np.array_split(data, int(data.shape[0] / float(rows) + 1))
    predictions = ''
    for array in split_array:
        predictions = ','.join([predictions, model.predict(array).decode('utf-8')])

    preds = np.fromstring(predictions[1:], sep=',')
    confusion_matrix = pd.crosstab(index=labels, columns=np.round(preds), rownames=['True'], colnames=['predictions']).astype(int)
    plt.figure(figsize = (5,5))
    sns.heatmap(confusion_matrix, annot=True, fmt=' .2f', cmap="YlGnBu").set_title('Confusion Matrix')

predict_xgboost(xgb_predictor, test_features, test_labels)
```



```
In [84]: from sagemaker.tuner import IntegerParameter, CategoricalParameter, ContinuousParameter, HyperparameterTuner

hyperparameter_ranges_xgb = {'eta': ContinuousParameter(0.01, 0.2),
                             'max_depth': IntegerParameter(3, 9),
                             'gamma': IntegerParameter(0, 5),
                             'min_child_weight': IntegerParameter(2, 6),
                             'subsample': ContinuousParameter(0.5, 0.9),
                             'colsample_bytree': ContinuousParameter(0.5, 0.9)}

objective_metric_name_xgb = 'validation:auc'

tuner_xgb = HyperparameterTuner(xgb,
                                  objective_metric_name_xgb,
                                  hyperparameter_ranges_xgb,
                                  max_jobs=10,
                                  max_parallel_jobs=1)

tuner_xgb.fit({'train': s3_input_train, 'validation': s3_input_validation})
```

.....
[< >]

```
In [85]: client = boto3.Session().client('sagemaker')
tuning_job_result = client.describe_hyper_parameter_tuning_job(HyperParameterTuningJobName=tuner_xgb.latest_tuning_job.job_name)

status = tuning_job_result['HyperParameterTuningJobStatus']
while status != 'Completed':
    print('Reminder: the tuning job has not been completed.')

    job_count = tuning_job_result['TrainingJobStatusCounters']['Completed']
    print("%d training jobs have completed" % job_count)

    time.sleep(180)

    tuning_job_result = client.describe_hyper_parameter_tuning_job(HyperParameterTuningJobName=tuner_xgb.latest_tuning_job.job_name)
    status = tuning_job_result['HyperParameterTuningJobStatus']

print("Training jobs have completed")
is_minimize = (tuning_job_result['HyperParameterTuningJobConfig']['HyperParameterTuningJobObjective']['Type'] != 'Maximize')
objective_name = tuning_job_result['HyperParameterTuningJobConfig']['HyperParameterTuningJobObjective']['MetricName']
```

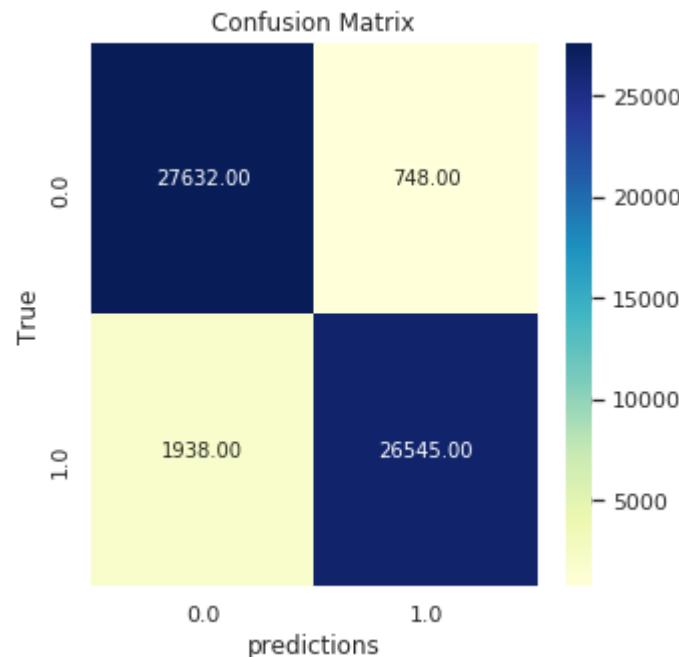
Training jobs have completed

Deploy your tuned model on Amazon SageMaker.

```
In [86]: xgb_predictor_tuned = tuner_xgb.deploy(initial_instance_count=1,  
                                             instance_type='ml.m4.xlarge',  
                                             serializer=CSVSerializer() )
```

```
2020-11-11 17:27:22 Starting - Preparing the instances for training  
2020-11-11 17:27:22 Downloading - Downloading input data  
2020-11-11 17:27:22 Training - Training image download completed. Training in  
progress.  
2020-11-11 17:27:22 Uploading - Uploading generated training model  
2020-11-11 17:27:22 Completed - Training job completed  
-----!
```

```
In [87]: predict_xgboost(xgb_predictor_tuned, test_features, test_labels)
```



Conclusion

You've now gone through at least a couple iterations of training and evaluating your model. It's time to wrap up this project and reflect on what you've learned and what types of steps you might take moving forward (assuming you had more time). Use the cell below to answer some of these and other relevant questions:

1. Does your model performance meet your business goal? If not, what are some things you'd do differently if you had more time for tuning?
2. To what extent did your model improve as you made changes to your dataset, features, and hyperparameters? What techniques did you employ throughout this project that you felt yielded the greatest improvements in your model?
3. What were some of the biggest challenges you encountered throughout this project?
4. What outstanding questions do you have about aspects of the pipeline that just didn't make sense to you?
5. What were the three most important things you learned about machine learning while completing this project?

Project presentation: Summarize your answers to these questions in your project presentation as well. Pull together all of your notes for your project presentation at this point and prepare to present your findings to the class.

In []: